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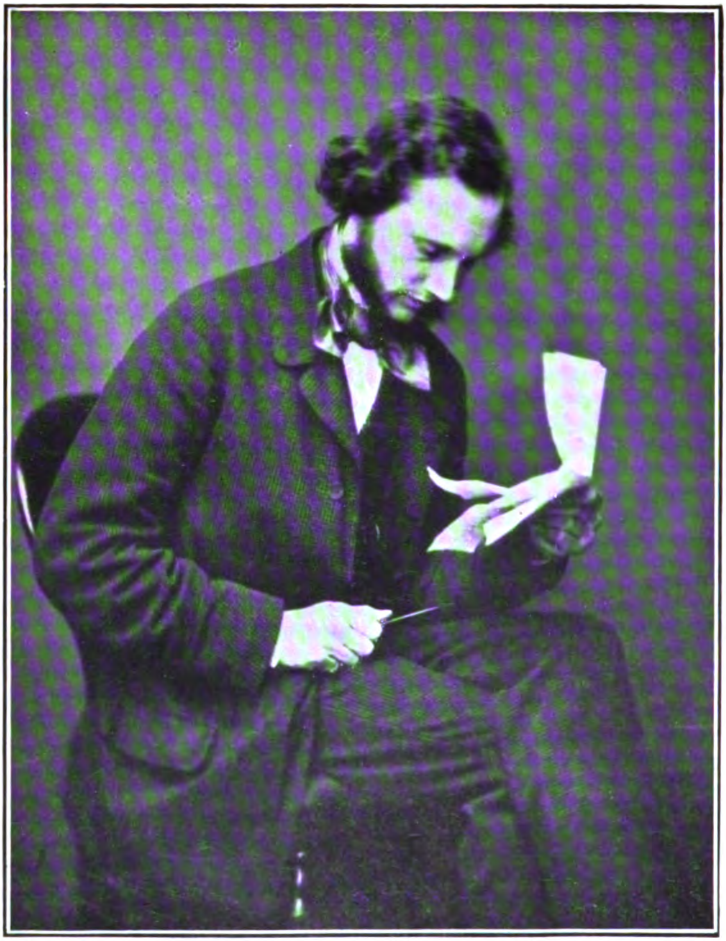
KELVIN THE MAN



(W Thomson) reading a letter or letters from Fleeming Jenkin, about experiments on sub-marine cables probably about March 1859

K, 24 Hamilton Terrace Ln. Nov 23/92

Photo by the Rev. Dr. King taken with one of the first cameras made

Frontispiece

KELVIN THE MAN

A BIOGRAPHICAL SKETCH BY HIS NIECE

AGNES GARDNER KING

WITH AN INTRODUCTION BY

SIR DONALD MACALISTER, BT., K.C.B.

PRINCIPAL AND VICE-CHANCELLOR OF
GLASGOW UNIVERSITY

HODDER AND STOUGHTON
LIMITED LONDON

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1952

First published . . . 1925

Made and Printed in Great Britain
T. and A. Constable Ltd., Printers, Edinburgh

THIS BOOK IS AFFECTIONATELY
DEDICATED TO MY NEPHEWS AND
NIECES, WHOSE LOVE HAS FILLED
MY LIFE WITH SUNSHINE

PREFACE

WRITING this simple narrative has been a great pleasure to me, but it is with some diffidence that I present it to the public; I should indeed hardly have ventured to do so without the kind encouragement of Sir Donald MacAlister and others whose opinion I value.

My aim has been to make Lord Kelvin a living personality to those who know him only as a great man of science, and to reveal the wonderful happiness of a pure life, inspired by a high ideal and filled with strenuous work. I shall be very thankful if the book serves in any way to show, especially to the young who have life before them, that far greater joy is reached in the pursuit of knowledge than in the pursuit of pleasure, and in the spirited contest with difficulties than in lazy ease: and, above all, that the highest and most lasting happiness is attained in an atmosphere of intellectual refinement and unselfish endeavour.

AGNES GARDNER KING.

HARTWELL, WROXHAM,
NORFOLK, *December* 1924.

INTRODUCTION

The Centenary of Lord Kelvin's birth has this year been fitly celebrated in Glasgow, in London, and Overseas by bodies of learned men, who have borne witness to his scientific genius and to the far-reaching results of his life's work for the advancement of knowledge. His name and fame have thereby been recalled to thousands of ordinary people who, though unskilled in the sciences, were moved to wonder 'What manner of *man* was Lord Kelvin, apart from the great things we hear that he accomplished?' The *Life of Lord Kelvin*, published in 1910 by Silvanus P. Thompson, gives a full and exact account of his remarkable career, and of his many inventions and discoveries. But to follow this biography with complete understanding throughout, the reader must bring to it a mind already familiar with the language of Mathematics and Physics. For a picture of the life, from childhood to adolescence, of Lord Kelvin, as a member of a singularly gifted and harmonious family, the biographer himself refers the reader to *Lord Kelvin's Early Home, being the recollections of his sister, the late Mrs. Elizabeth King*, issued by his niece, the late Miss Elizabeth Thomson King, in 1909. Professor Silvanus Thompson says he has purposely abstained from trenching on that narrative, which brings the story of Lord Kelvin's early years up to 1849. There was therefore a gap to be filled in the story of his personal and family life as known to those near and dear to him, and this, another niece, Miss Agnes Gardner King, has now supplied in the present book : *Kelvin the Man*. It will bring home to many, who know little more than the name of Lord Kelvin, the loving and lovable nature of that great man of Science, his deep humility of soul, and his constant concern that his exploration of nature's secrets should issue in benefits to mankind. I venture to say that his niece's testimony to Lord Kelvin's character, the testimony of an eye-witness in intimate touch with his home, and capable of putting down in simple and vivid words what she saw and heard, will crown as with a garland of home-grown flowers the Centenary Memorial raised to his scientific fame.

As Secretary and Recorder of Section A (Mathematics and Physics) at many meetings of the British Association, which were quickened and glorified by Lord Kelvin's presence, and as his Vice-Chancellor and the last doctor to be ' capped ' by him in his capacity of Chancellor of this University, I deem it a privilege to be associated, however slightly, with Miss Gardner King's book.

DONALD MACALISTER.

UNIVERSITY OF GLASGOW,
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CHAPTER I

EARLY YEARS

ON a bright summer's day, the 26th of June 1824, William, the future Lord Kelvin, was born. He first saw the light in a comfortable house built by his father, Professor James Thomson, in what was then the outskirts of Belfast. He was a beautiful child—so beautiful that an artist of the name of Warrington painted him as an angel. Nurse Sally took him to the studio in ribbons and lace, and was much offended with the artist's preference for Nature's dress!

There is much discussion nowadays as to the amount of discipline that is good for children, and the severity of the old days is contrasted with the leniency of to-day. The hard discipline to which William Thomson had to submit certainly made a man of him. Nurse Sally, who reigned supreme in her department, was very severe. She kept a stiff feather over a picture above the nursery chimney-piece; this was her 'sceptre of rule and rod of correction,' and she brought any offender to immediate repentance by looking very stern and pointing at the instrument of torture. The children were in too great terror of its unknown possibilities to risk its use, so there it sat in horrible majesty. In spite of her severity, however, Sally was greatly beloved by her young charges, and she early instilled into them principles of order and decorum, for which they were afterwards grateful.

William Thomson's mother, Margaret Gardner, was highly cultured, and both beautiful and talented; but when the boy was only six years old she died, leaving seven children, two of them in arms. A touching letter from her sister to an aunt, telling of her death, describes her farewells to her children. When James and William were brought in, 'Willie sat down on a sofa opposite her, and when her eye rested on his fair young face it quite overcame her; never can I forget her look as their Papa led them out and her tone as she exclaimed, "My beloved boys."'

My grandfather then became both father and mother to his children. There is a beautiful picture in my mother's recollections of his gathering them about him on the evening of their mother's death. 'When the twilight was deepening, the five elder children were taken down to our father's study. He was sitting there alone, at the side of the fire. As the little troop came into the room, he opened his arms wide, and we ran into them, and he clasped us all to his heart. I was the tallest, and his head fell on my shoulder, and with a choking voice he said: 'You have no mamma now.' He held us a long time so: his whole breast heaving with convulsive sobs. Then he gathered the two little ones, William and John, on his knees, and kept his arms tight round us all—his head resting on the cluster of young heads closely pressed together, and there we remained in silence and darkness, except for the glow of the dying embers, till at last the nurse came and asked leave to put us to bed.'

Lord Kelvin's father was a very remarkable man and early evinced great talent. He sprang from the fine old stock of Scottish Covenanters, who in the days of the persecutions of Claverhouse, between 1671 and 1680, fled to the North of Ireland and there formed new homes; and the old farm-house, Annachmore in County Down, which the Thomson family held till 1847, still exists.

Education, especially in out-of-the-way places, was not easily obtained in those days; but my grandfather's own extraordinary ability enabled him to gather knowledge for himself. When quite a child he worked out the theory of dialling and made sundials of slate, both for the horizontal and for the vertical positions, which are perfectly true, and are now in the possession of his grandson, James Thomson of Newcastle-on-Tyne.

By his own exertions he succeeded in becoming a student in Glasgow University, where he distinguished himself; and later he obtained the Mathematical Chair in the Royal Belfast Academical Institution, and taught also the Geography and Arithmetic classes. He also wrote a great many educational books which went through innumerable editions, and which were still in use till quite recently.

Besides all this he found time to carry on most of the education of his children himself, and a splendid education it was. His literary work was accomplished in the morning by rising about four o'clock, so his evenings were free for his children.

Willie was not yet four when after dinner their father every evening put the celestial and terrestrial globes, which I now possess, on the table, and taught the four elder children Astronomy and Geography, James and Willie being placed on the table beside the globes. Willie's interest and wonder were thus early excited, and by the time he was six he had grasped a good deal and was eager to know more. The daily constitutionals were also utilised for instruction, and so skilfully that they seemed play.

My uncle often spoke feelingly of the great debt of gratitude he owed his father. He drew out an intense affection from his children, and his name was the last on my mother's lips. When she and her brothers were together, conversation always went back to the old days, each in turn recalling some happy memory. They were thus engaged in our garden when I made the sketches for my picture now in the National Portrait Gallery.

In 1831 the family moved to Glasgow, where my

WILLIAM, JAMES, AND ELIZABETH

TALKING OF OLD TIMES IN THE HAMILTON TERRACE GARDEN, 1885

From a drawing by Agnes Gardner King, now in the National Portrait Gallery

grandfather had been elected to the Chair of Mathematics. There were then six children, one of the babies having died. My mother was the eldest, and James and William the third and fourth.[1]

The two elder boys were allowed to sit by their father as listeners during class. Once, when William was only eight, a question passed all round to which no student could reply, and the boy startled the class by calling out beseechingly, 'Please, papa, do let me answer!' Two years later, when only children of ten and twelve, they became regular students at the University, and what is more they carried off almost all the prizes, William the first and James the second. The prizes they took were for Latin and Greek as well as Mathematics and Astronomy and Natural Philosophy. When only twelve William got a prize for translating Lucian's *Dialogues of the Gods*, with full parsing of the first three dialogues. This early advancement on his part probably accounted for his very exalted view on the capacity of boys and on the scope of their education: in 1907, shortly before his death, he said: 'A boy should have learned by the age of twelve to write his own language with accuracy and some elegance. He should have a reading knowledge of French, should be able to translate

---

[1] Anna, the second daughter, married William Bottomley and died young, leaving six children. John, the third son, a very fine young man, died of fever when 'walking the hospital' while he was studying as a doctor. Robert, the youngest child, emigrated to Australia, where he married and had three daughters and no sons.

Latin and easy Greek authors, and should have some acquaintance with German; having thus learned the meaning of words the boy should study logic!'

Although William, the younger brother, took a higher place than James, there was never any jealousy between them. They were devoted friends to the end of their lives, and when together, they soared into the furthest realms of Science, and were lost to everything and every one else; so much so that at the College dinner parties Lady Kelvin found it necessary to place the brothers as far apart as possible to prevent their getting immersed in some deep scientific subject.

On one occasion when I was seated between Lord Kelvin at the foot of the table and Professor James at the side, I was soon completely boxed in by talk far above my comprehension, and entirely cut off from the lively conversation beyond. Another time I remember their being in earnest conversation, when Professor James was seeing his brother off on a steamer. The steamer began to move, Professor James drew nearer and nearer the edge, talking and talking; finally he stretched out his umbrella, and tried to hold the steamer, but in vain! We were much afraid he would lose his balance and fall in.

CHAPTER II

CAMBRIDGE

WILLIAM had not completed his seventeenth year when, on the 6th of April 1841, he was entered as a student of St. Peter's College at Cambridge. It was about this time that my mother's drawing of him, now in the National Portrait Gallery, was done. The summer before, his selection of books for his own holiday diversion was: Fourier's *Théorie Analytique de la Chaleur*, and Laplace's *Mécanique Céleste*—strange choice for a boy not yet sixteen! Yet there never was a more boyish boy or one more full of fun. His laugh was as infectious when a boy as was his smile in later life; but the laugh sometimes got him and his companions into trouble, when at awkward moments, during a lecture or in church, for instance, he saw the comic side of things. Once indeed, at a revival service in the Highlands, he became so overcome when the congregation got excited, that the minister pointed at him and said: 'Ye 'll no lauch when ye 're in hell!' This thoroughly finished him and his brothers too, and my mother, as the eldest, had to marshal them all out of church; but this was when they were very young.

Fourier's book was the cause of horrible disobedience on the part of Willie. Their father took all the children to Bonn in the summer, that they might acquire German and have a holiday at the same time. There were to be no books or lessons, but Fourier's book was slipped in by Willie and surreptitiously studied in a cellar, and to very good purpose too, for he found that an attack on the book by Professor Kelland was not justified. When he confessed to his father, his secret study and his discovery, he was not severely handled. He was advised on the contrary to put the matter before Kelland, which he did politely in his round, childish handwriting, and Professor Kelland in the end generously acknowledged himself convinced, and a real friendship sprang up between the man and the boy.

William was a great favourite at Cambridge, and I feel sure he must have had a strong influence for good. His joyousness and his success in games (for he won many trophies in boat races) would make his uprightness and purity of character attractive, and his unassuming modesty would prevent jealousy of his distinction. To the end of his life he delighted to talk of his College days, and many times he spoke of them to students, and besought them to keep their College life 'full of pictures which are bright and clear and clean,' so that when old they could look back to them with pure happiness and with no regret or shame.

A letter from my mother fifty years later shows his joy in recalling his College days :—

'In the lovely upper study where we three [Lord and Lady Kelvin and herself] are snugly sitting and very happy together, 19*th Jan*. 1892.

'My dear Daughters,—How I wish I could tell you in his own words all Uncle W. has been saying during dinner, and since we came up here, and paint his bright face while he is talking. Aunt Fanny has now set him down, rather loath, to acknowledge some of his congratulatory letters [on the Peerage] ; she has sorted them and placed pen and ink before him with the electric light shining down upon him, but though all is so comfortably arranged, and she has coaxed him so sweetly he would rather have reposed in his armchair to " fight his battles o'er again and show how fields (or races) are won." A letter from Mr. Justice Denman sent him back to his undergraduate days, and he has been describing with great glee a race or trial between Peterhouse and Caius, which was run over and over again before Caius yielded to Peterhouse. If you could only have heard and seen him, and heard his description of Denman's eagerness for his own College and the joy of the master of Peterhouse over the victory—and when at another time Uncle William won the silver sculls he declared it was better than winning in an examination.

'Next we talked of his first going to Cambridge and the incidents of the journey, how we travelled in the mail coach, with a pleasant Swedish gentleman making the fourth inside passenger, starting, I think, about seven on a bright October morning, and arriving at Carlisle in the evening, staying in a hotel that seemed so bright and comfortable, and the tea perfectly luxurious. Next morning, still with beautiful weather, we started again as inside passengers in the mail coach for Hull, and dined by the way, and reached our destination before sunset. On my account we ferried across the Humber, and I was put into a carriage to drive to Mr. Saltmarsh's. Your grandfather and Uncle W. were to have gone by sea to London, but they did not like the look of the cabin or the berths, though the Captain assured them they were "very hairy," and they took the mail coach again all the way to Cambridge which they reached without adventure.'

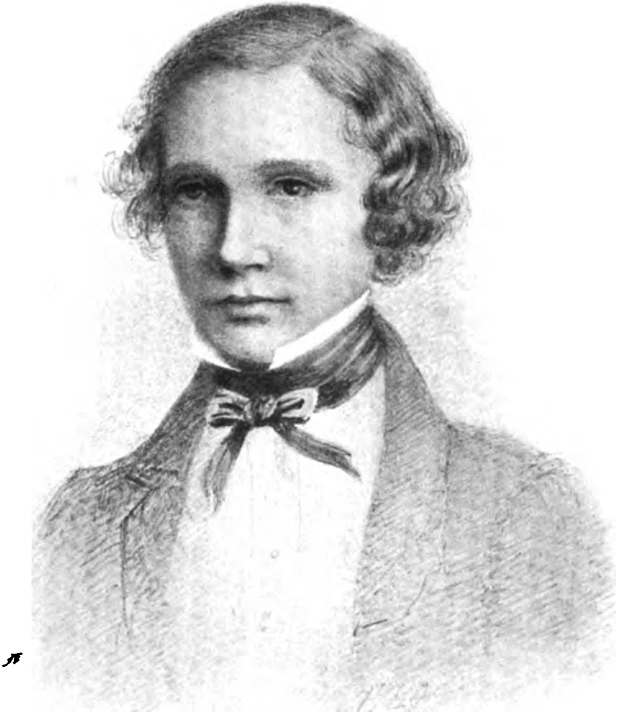
Lord Kelvin had a wonderful aptitude for friendship, and his chivalrous nature evoked very strong affection, even some of those with whom he had oftenest crossed swords becoming his closest friends. He was a good judge of character and chose his friends well, his boyhood friends being friends for life. Many of them distinguished themselves and several, like himself, obtained peerages. We met Canon Grenside when he was over eighty, and he told us that he and Lord Kelvin had been great friends at Cambridge, and that he was a guest at his first wine party, and had kept his invitation card, which he gave to me. He remembered my uncle as a most engaging boy, brimful of fun and mischief, a high intellectual forehead, with fair, curly hair and a beauty that was almost girlish.

It was not very easy for my grandfather with his large young family to spare the necessary funds for Cambridge, and his letters frequently upbraid William for extravagance, but it was generally books he got into trouble about; the books he fancied were expensive, and moreover good books must have good clothes! Once when he and a friend had gone to choose a new binding for a favourite, where the assistant was French, he was asked if it should be done 'in calf or in mutton?' William was so amused that he fell quite off his chair with laughing.

He was not, however, wholly neglectful of economy, for he resisted the temptation to put his name down at a fashionable hairdresser's to have his hair attended to at 2s. 6d. a term. 'I declined the tempting and advantageous offer, considering that my hairdressing has cost me 2d. the half-year hitherto.' But in his case going to a fashionable hairdresser was not always waste of time and money. Later when he was having his hair cut at Sturrock's in Buchanan Street, Glasgow, his attention was attracted by a revolving india-rubber rope or chain for driving a rotatory hair-brush. As soon as he could get free he made his way excitedly into White's scientific instrument shop near by, and without any explanation he hurried the astonished Mr. White back with him to the hairdresser, and pointing to the chain, bade him observe the rigidity its motion gave it, and told him to have one exactly like it put up immediately in his class-room.

When the examination for the Mathematical Tripos came at the beginning of 1845, young Thomson was already recognised as the ablest mathematician of his year. He graduated, however, as Second Wrangler, the Senior Wrangler being a competitor who was quicker and more expert in 'writing out' the matter of the text-books, and less concerned with original problems, over which Thomson spent more time than was profitable. When, however, all the higher wranglers were examined a few days after for the 'Smith's Prizes,' which allowed more scope for originality and less for mere memory, Thomson came out First Prizeman, and so verified the predictions of his teachers and friends.

In June 1844 a reading party was arranged and rooms taken at Cromer. William wrote: 'My address will be Cromer, Norfolk, which I suppose will be sufficient, as it is a small place. To prevent mistakes, however, it might be as well to put on the address of the first two or three letters "of St. Peter's College, Cambridge," after my name.'



WILLIAM AT THE AGE OF SIXTEEN

From a pencil drawing by his sister Elizabeth, now in the National Portrait Gallery

It would be interesting to know which was the house, but it has probably been swallowed up long ago by the sea, for it was on the very edge of the crumbling cliff, and the young fellows nicknamed it 'Jeopardy College.'

My grandfather wrote anxiously about money :—

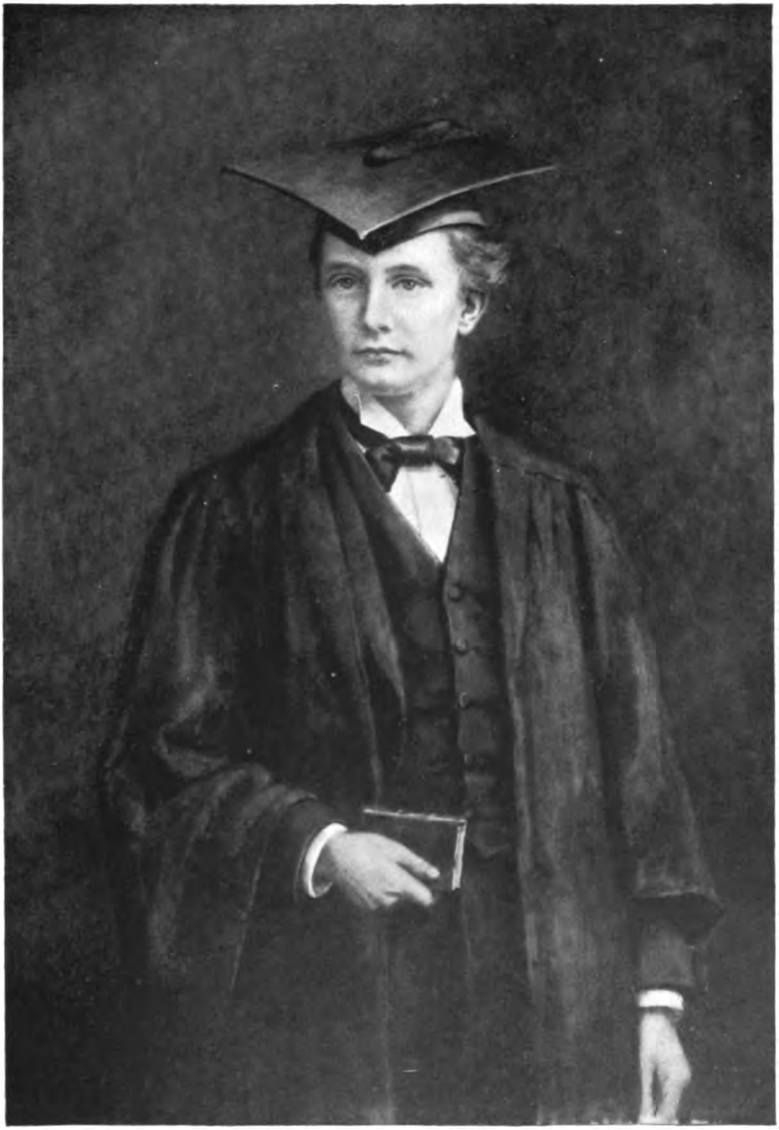
'In going to Cromer, or elsewhere, you must of course do as others do with regard to expense for lodgings, etc. You may have it in your power, however, consistently with propriety, directly or indirectly, to check extravagance in such things, and you ought to do so.' The money, however, melts away, and William takes it very gaily :—'*June* 13, 1844. MY DEAR FATHER,—I have again to write to you on the same pleasant business that I had to write to you about so lately, which is to say that my money is again all gone. I spent nearly all the money you sent me in paying my Cambridge bills before I left, and the journey here, which was rather expensive, and my first week's expenses here have exhausted my stock so that I have only half a crown left. . . .

'This is a very pleasant place for England, and especially for Norfolk, which is rather remarkable for its dullness. The whole country is elevated on the top of high steep cliffs of sand, and it is encroached upon every high tide by the sea. The house we are in cannot survive another winter, I think, unless great care is taken to protect the cliff below it with a wall. This was attempted to be done some time ago, but the first rough weather at spring tide carried a great part of it away. We have been bathing regularly since we came, and walk about a great deal, so we are making the best use of the sea air we can. . . .'

William spent a good deal of his time spinning humming-tops, flinging skipping-stones, and rolling hoops. It sounds sweetly childish, but problems were involved, some of which occupied him through his whole long life. In a letter dated 10th July he wrote: 'I have been investigating, as far as I have been able in the time I have been able to spare, the theory of spinning tops and rolling hoops, which is very curious and difficult. Blackburn and I have been making a great many experiments on the subject, and have collected quite a cabinet of ellipsoids of various proportions, which we find on the beach, besides having got a teetotum, humming-top, and peery. Some of the results we have obtained are very curious.'

In June 1845, money difficulties were greatly relieved by William being elected to a Fellowship worth £200 per annum, and he wrote to his father from Cambridge, telling him the very delightful news :—

'My dear Father,—I have been elected Foundation Fellow this morning, very much contrary to my expectations this day week when I became



DAVID THOMSON KING

From a painting by Elizabeth Thomson King

candidate. You must know very well how glad I am of it, so I need not say any more. I hope you had a pleasant journey.—Your affectionate son,

WILLIAM THOMSON.'

On 9th July my father wrote from London to my mother, on his way back from a conference in Geneva:—

'I went express this morning from London to see William, and I have just returned to the Metropolis . . . suffice it now to express the joy with which I learned from William that he has already got a Fellowship and a number of pupils! He has all the appearance of being destined to fill a very exalted place in the estimation and, I may add, in the affection of his age and country.'

CHAPTER III

THE PROFESSORSHIP

WILLIAM had distinguished himself so highly at Cambridge that, a vacancy having occurred, he was unanimously elected to the Chair of Natural Philosophy in Glasgow University, in September 1846.

The event was a great delight to the whole family, and his father was quite overcome with joy at having his beloved son, when only twenty-two, settled beside him. A letter to my mother from my father, the Rev. Dr. David King, says : ‘The first announcement I had on the subject was your father’s face as he came out of the hall where the election had been conducted. A countenance more expressive of delight was never witnessed. The emotion was so strong and marked, I only fear it may have done him injury.’

My grandfather did not live long to enjoy this great culmination of his happiness. In the winter of 1848-49 a terrible visitation of cholera plunged Glasgow in mourning. The lugubrious bell of the dead-cart tolled through the night air, inviting the people to bring out their dead. Hardly a house

PROFESSOR JAMES THOMSON, LORD KELVIN'S FATHER

From a pencil drawing by his daughter Elizabeth (Mrs. King)

escaped the scourge, rich and poor alike falling victims.

My grandfather took the malady, and though in his case the attack was not severe, he could not master the subsequent weakness, and a letter to my father from my uncle brings the sad news of his death on the 12th January 1849 :—

'My dear David,—I have sad, sad intelligence to give you. We have lost our father. He died this afternoon at two o'clock. . . . I could not believe last night at this time that we were to lose him . . . but God has ruled it for the best, and has tried us with a heavy affliction . . . it is a terrible and irreparable loss, and a sad void is now left. . . . Poor Elizabeth will indeed need your consolation.—Your affectionate brother,

William Thomson.'

My uncle remained in the parental home in the University, an aunt keeping house for him till his marriage in 1852.

When the young professor first took his place in the Natural Philosophy class-room it was embarrassing to face the rows of benches filled with students, some of them older than himself; and according to his own account his first lecture was a failure. By the end of the session, however, there was no doubt of his success. An old letter telling of the prize-giving speaks of the deafening cheers that greeted the young professor, even the grave old professors forgetting their dignity and applauding with hands and feet, while 'William himself looked so young and modest that it was quite touching to see him.' For fifty-three years he was the shining light of that University. Many of his discoveries were made while demonstrating to his students, and any of them clever enough to understand were the first to see them. Such times of thrilling inspiration proved life-long memories to those young men, and have helped some of them to become great themselves.

Lord Kelvin's influence was most inspiring to the whole University. His own high ideal of thought, and life, and work, combined with his intense personality and great lovableness, had an elevating effect on all about him, and were appreciated even by those who had no conception of his genius, and who were quite unable to follow his flights into the higher realms of Science in which he could not help indulging when lecturing to his students. The lectures were never dull and monotonous, they partook of his own freshness, which he carried with him to the end of his long life. Surprises might be looked for any time—some completely new idea found, there and then, and exhibited with the delight of discovery—something which could not but make an impression, and which the most ordinary would carry away and remember with pleasure afterwards.

Dr. David Murray of Glasgow, referring to his student days in Lord Kelvin's class, says: 'He was always in earnest, and when dealing with great problems, spoke with the fervour of a missionary charged with a weighty message. It was a strange sight to watch him as he became more and more eager in his exposition; a light seemed to play upon his forehead like an emanation. I have watched Gladstone in his most passionate outbursts, but although the struggle of a great soul was to be seen in every feature, it never irradiated his brow as it did that of William Thomson. It was a rare privilege to witness the movements of the mind expressed in feature and in gesture, to behold the living spirit visibly present. His was a unique personality: genius of the highest order, coupled with sound judgment and practical ability; passionate earnestness and deep reverence; a modesty and simplicity of character seldom met with.'

His original methods of demonstrating his theories were always a source of unfailing delight to his students. When lecturing on vibration and sound, he would produce the French horn he had played when a member of the Cambridge Musical Society, and bring forth a variety of tones which invariably drew out the cheers of the class, followed by the cry of 'Silence!' from the Professor. Even more delighted and irrepressible applause was excited when he brought out his old Jacob Volunteer rifle, and fired it at the heavy bob of a ballistic pendulum, to show the displacement produced by the impact of the bullet.

Of course the students ragged him when they could, but his sense of humour enabled him to understand youth and to control it too, and he never allowed them to go too far. When a rather conceited student at an examination attempted to fool him with facetious answers, the Professor turned on him, and administered a very severe reprimand in a few telling words, making an exceedingly strong impression on all present. Irreverence of any kind was even more severely dealt with.

In their practical jokes the students seldom got the better of him ; for instance, when he was using a boiled and a raw egg to demonstrate the difference under rotation between a solid body and one with liquid inside, expecting to puzzle him, they substituted two boiled ones. But he simply spun them, then looking round quietly remarked : ‘ Both boiled, gentlemen.’ Once, however, they did catch him : his definition of a certain magnet as ‘ an infinitely long, infinitely thin, uniform, and uniformly and longitudinally magnetised bar ’ never failed to call forth cheers, followed by ‘ Silence ’ from the Professor. On one occasion the young rascals agreed together not to applaud the definition, and to their intense satisfaction ‘ Silence ’ came out as usual. Lord Kelvin explained afterwards, with a twinkle in his eye, that it was a ‘ reflex caused by the definition.’

There was a kindly camaraderie between himself and his students which made them all feel that he was their friend, and he always looked upon himself as one of them. When, on Graduation Day, in 1891, the students were congratulating him on his election as President of the Royal Society, he said: 'I have been a student of the University of Glasgow fifty-five years to-day, and hope to continue a student of the University as long as I live.'

Several times I heard him lecture at the Royal Institution and always enjoyed it, even when there was much that I could not understand: my intelligence, however, was roused to the utmost by his own great eagerness and the charm of his manner. He had also a way of making wonderfully lucid explanations of difficult subjects. 'Isoperimetrical Problems,' for instance, sounded most unpromising for a lecture, yet it was delightful. He used as examples to explain what an isoperimetrical problem was:—a tailor having a piece of cloth out of which he was to get the largest possible coat of the most fashionable make with the least possible waste; a gardener with a given square of ground growing the largest quantity of the most paying vegetables with the least possible expenditure of time and money; Dido, Queen of Carthage, cutting the ox-hide into very fine strips to make the promised area it should cover as large as possible, and other equally simple examples which left a very vivid impression of the meaning. In the middle of the lecture he found it necessary to make a very easy addition, and jotted down the figures on the blackboard, remarking: 'I am sure some of the younger people present would be better at this than I.' After studying the figures for some time, he carefully wrote down a completely wrong result, which was received with prolonged cheers. He looked round with some surprise, saying, 'I am afraid I have not got it right, but it should be something like that.' No mathematical flight ever baffled him, but it was extremely difficult for him to bring his mind down to ordinary arithmetic!

The following quotation from Lord Fisher's *Memories* is interesting in the present connection:—

'Lord Kelvin had a wonderful gift of being able to pursue abstruse investigations in the hubbub of a drawing-room full of visitors. He would produce a large green book out of a gamekeeper's pocket he had at the back of his coat, and suddenly go ahead with figures. I had an interesting episode once. Sir William Thomson, as he then was, had come with me for the first voyage of a new big cruiser that I commanded. I had arranged for various responsible persons to report to me at 8 A.M. how various parts of the ship were behaving. One of them reported that a rivet was loose, and there was a slight leak. I said casually: "I wonder how much water would come in if the rivet came out altogether." Sir William was sitting next me at breakfast, very much enjoying eggs and bacon, and he asked the Officer: "How big is the rivet?"

and whereabouts it was, etc. The Officer left, and Sir William went on with his eggs and bacon, and I talked to Sir Nathaniel Barnaby on the other side of me, who was the designer of the ship we were on. Presently Sir William, in a mild voice, never having ceased his eggs and bacon, said so much water would come in. Sir N. Barnaby thereupon worked it out on paper and said to Sir William: "You made a good guess." He replied, "I didn't guess, I worked it out."'

Lord Kelvin never thought it a trouble to answer any sensible question, or to explain any problem or the use of an instrument, and he would take great pains to make himself clear to the unlearned. An amusing example of this reached me lately. A lady who met him at a large garden party, when she was quite young, was rather alarmed when the great man was introduced to her. The heat of the day, however, opened the conversation, and he offered to fetch her an ice. She remarked that she wondered how the ice could be produced in such weather, which induced him at once to give simply and clearly the scientific explanation of its manufacture, to her great delight.

One evening in 1891 when I was staying in Glasgow, I dropped in at the College and found Lord Kelvin starting off to the laboratory to see how a new meter was working which he had just completed for measuring the amount of electricity used in electric lighting, and he took me with him. Light had been forgotten, so we had to grope our way along, and when at last matches and a guttered candle had been found, the vast laboratory with its medley of instruments looked weird and strange in the dim flickering light. The meter was working beautifully, and my uncle's delighted face was pleasant to see. Feeling my interest he took a great deal of trouble to explain its characteristics to me, though he knew my ignorance of Science. I asked him how long it had taken him to bring it to its present perfection. 'Ten years,' was the reply. No matter how much time and patience were required, nothing was ever left imperfect or unfinished.

The use of electricity for lighting had always interested Lord Kelvin immensely, and he was responsible for many of the instruments that made it possible—switches, fuses, suspensions, and such like. In 1881 he applied it to his own house in the University, the first example in Scotland, and great was the excitement and delight of all of us in first seeing a house actually lighted by electric light. It was rather startling, however, when my uncle wished to experiment, and kept popping it on and off, which was not infrequent.

There was no laboratory in the Glasgow University when Lord Kelvin first took his seat there, nor in fact was there one in any other university in the world. Soon, however, he realised the necessity for experimental accommodation in connexion with Natural Philosophy, and he appropriated an empty wine-cellar adjoining the class-room which had probably served, in the old jovial days when wine parties were universal, to store private supplies for the professors. This room, with no conveniences and not over good light, was for eighteen years the centre of the most extraordinary activity: inventions had their birth there which are at the root of much that is of world-wide importance to-day, and science made strides unthought of before. Later, another room was added, and when the new University on Gilmore Hill was built, the laboratory was considered all important, and a special structure was provided with what was then deemed every modern convenience and luxury. But probably as happy days were spent in the old pioneer laboratory, when the bright enthusiasm of youth was brilliantly conquering all difficulties.

Whatever experiments and investigations my uncle was himself engaged on were shared with his students. Shortly after being installed as Professor, and having got his wine-cellar into working order as a laboratory, he was asked to write an article on 'Heat' for the *Encyclopædia Britannica*. He took the article very seriously and instituted a number of researches into all the various branches of heat, which had not yet been fully explored, among them 'Steam Thermometry.' For this he wished to test the vapours of various acids. When he and his students were all busy producing sulphurous acid, by heating copper in sulphuric acid and condensing the gas given off, in tubes immersed in freezing mixtures, and the whole place was full of the most abominable smell, an eminent chemist came to pay his respects to the young Professor, and to see how he was getting on. After an exchange of greetings, the Professor inveigled his visitor into the work: 'We are all very busy brewing liquid sulphurous acid, for use in sulphurous acid steam thermometers; we want a large quantity of the liquid; would you mind helping us?' Much amused he good-naturedly agreed, and the intended call extended itself over several hours, his interest in the personality of his host making up for the condition of the atmosphere and the messy elementary work.

It has been erroneously stated in several quarters that the first laboratory was a coal-cellar with the coal actually in use in it. Even William Thomson's ingenuity could not have overcome coal-dust among his experiments, and it is difficult to understand how such a misapprehension could have arisen.

This chapter on the professorship could not end more fittingly, than with a quotation from the address presented to Lord Kelvin by his own beloved University on the occasion of his Jubilee:—

'The fifty years during which you have occupied the Chair of Natural Philosophy in this University have to an extent unparalleled in the history of the world been marked by brilliant discoveries in every department of Physical Science, and by the prompt adaptation of many of these discoveries to meet the practical needs of mankind. We recognise with admiration that in both these respects you have been a leader of the age in which we live. Your mathematical and experimental genius has unveiled the secrets of nature; your marvellous gift of utilising such discoveries has ministered in many ways to the happiness and dignity of human life. Your name and your work have been an inspiration to the physicists of the world: new departments of technical industry have sprung into existence under your hand; and even the unlettered have learned to value the gifts which science bestows. The justice of the tributes which have been paid to you by Universities and Scientific Societies at home and abroad, and by the Governments of this and other lands, we are proud to acknowledge. But only your colleagues in University work are in a position to appreciate the versatility of faculty, the exhaustless energy, and the tenacity of purpose which have enabled you to grapple successfully with problems the most varied, and to reveal to us on every side the reign of order and law. In the midst of all, you have endeared yourself to us by the graces of your personal character, notably by that simplicity which, unmarred by honours or success, remains the permanent possession of transcendent genius, and by that humility of spirit which, the clearer the vision of truth becomes, bows with the lowlier reverence before the mystery of the universe.'

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CHAPTER IV

RELIGIOUS FAITH

All through life Lord Kelvin retained a wonderful simplicity of character, which endeared him to every one. He had a simple, childlike faith which pervaded his whole being. The deeper he delved into Science and the more he studied its mysteries, the greater his veneration for the Maker of all.

'We must pause,' he said, 'face to face with the mystery and miracle of creation . . . the relations of matter and life are infinitely too complex for the human mind to understand. . . . The opening of a bud, the growth of a leaf, the astonishing development of beauty in a flower involve physical operations far beyond our comprehension. . . . A tree contains more mystery of creative power than the sun, from which all its mechanical energy is borrowed. An earth without life, a sun, and countless stars, contain less wonder than that sprig of mignonette. . . . Let us not imagine that any hocus-pocus of electricity or viscous fluid will make a living cell.' Again he said: 'If you think strongly enough, you will be forced by Science to a belief in God, which is the foundation of all religion.'

The Bible he reverenced; he had studied it with care and was at home in it, but he seldom spoke of religious matters, or entered into arguments about them; his faith, however, lay at the root of his whole being and pervaded all his work, lifting it to the highest level. He always began his class in college with prayer, and chose the third Collect for Grace from the Church of England Service, and he was a regular communicant in the Church of England, though in Scotland he often attended the Scottish Church. I loved to go to church with him; there was something in his humble and quiet reverence which seemed to strengthen one's own faith and bring one directly into the Presence of God.

When he was staying with us in London in 1888, Sunday proved too wet for us to venture to church, and he suggested our having a Bible-reading together. To quote from my sister, Elizabeth Thomson King's diary: 'Bibles were brought out, old version and new, and he began turning up passages, discussing the genuineness of Old Testament history, comparing dates about the prophecies and consulting Biblical dictionaries in relation to debated points, all with the liveliest interest. The story of Cyrus, and the prophecies found in Isaiah regarding him, were among the topics which occupied us. Afterwards I brought out my Queen's College lecture in 1864, and showed Uncle William the copies I had made of ancient maps according to Ptolemy A.D. 120, and some ditto of the fourteenth century, which he examined with great care and interest. He remarked what a pity it is that maps are not more universally given in Bibles, as it would add so very much to the interest of the study of the book ; he also thought it was a great blank not having the dates at the top of the pages in the new version. Where they are only guessed at in the very ancient records he would have them put with a question mark, but when we get to the time of Solomon and so on the dates are as accurately known, he says, as that of the battle of Hastings.

'In the evening mother read aloud Darwin's confession of faith, or rather his confession of want of faith. Uncle William said of his views about the absence of evidence of design, that he considered such views utterly unscientific. He expressed himself very vehemently on the subject, and said that our own power of discussing and speculating about Atheism and Materialism was enough of itself to disprove such a theory. With regard to Evolution, he said that it could not in the least degree explain the great mystery of nature and creation : if all things originated in a single germ, then that germ contained in it all the marvels of creation, physical, intellectual and spiritual to be afterwards developed. It is absolutely impossible that atoms of dead matter should come together so as to make life.'

His work was to him a kind of worship. His close study of the phenomena of nature and his constant discovery of new marvels seemed to bring him nearer and nearer to God, and he could never understand any one treating Science with any other feeling than reverence. All the occurrences of daily life which seem natural to us were wonderful to him. From the vibration of a dewdrop to the movements of the most distant stars, he gave his mind to solve the meaning, and in some of the simplest things lay the deepest problems. Each problem as it was solved was generally broken in and saddled for some practical use; then, 'forgetting those things which are behind,' he set himself to 'press towards the mark,' and other problems filled his mind, and these, the unsolved problems, were all he thought of, some of them perhaps reaching too near the Infinite for possible solution here.

When his wonderful accomplished work had been acknowledged by every distinction every university and every country could give, and at his Jubilee the great had gathered from all over the world to do him homage, he humbly spoke of 'Failure.' Many have wondered what he could have meant, but those who knew him understood: his ideal was far too high to reach in this world, and as the years were closing in he was beginning sadly to realise it. But hope rose above his sense of failure and, undaunted, he pressed on, ever mounting towards the light and carrying in his heart the prayer that was so dear to him, 'Lighten our darkness, we beseech Thee, O Lord.'

CHAPTER V

HOME LIFE

Lord Kelvin never had any children of his own; but he drew his nephews and nieces about him, and no father could have been more loving or more beloved.

He was twice married. His first wife was Margaret Crum of Thornliebank, a highly cultured and intellectual lady. The wedding took place on 15th September 1852. There was a short wedding trip to Wales; but the real trip was postponed till the end of the session, when the young couple made an extended tour round the Mediterranean, visiting Gibraltar, Malta and Sicily, and other places. Sicily they explored, staying wherever they could find shelter, and travelling in any available conveyance—often walking long distances.

The rough accommodation, with no comforts, and the over-fatigue in travelling were too much for the young wife, whose great spirit prevented her giving in in time. A long and very serious illness was the result, from which, though she lived on for seventeen years, she never recovered, and all the rest of her life she was a great sufferer. My uncle's loving care of her was most touching. He carried her up and down stairs, sitting with her, and soothing her when her pain was severe, and doing all in his power to make life sweet to her in spite of her suffering. When she died he was heart-broken, and found it difficult to take up life with his natural keenness and pleasure.

It was then that he threw himself into yachting, and purchased the *Lalla Rookh*, which opened a new world of interest for him and led to several of his most valuable and best-known inventions. It was also in it that he brought home from Madeira his second wife, on his remarriage on the 4th July 1874.

The story is a romantic one. In June 1873 my uncle went out in the *Hooper* to lay a cable from Pernambuco to Pará. At Madeira a serious fault was discovered, and four hundred miles of cable had to be uncoiled to get at it, a prodigious work which took sixteen days. The Blandy family, however, who were the principal residents in Madeira, were very hospitable, and he quite enjoyed himself. In a letter he says: 'We had some admirable lamp-signalling several evenings at Funchal between the *Hooper* and Mr. Blandy's house, about 1½ miles distant. The Miss Blandys learned "Morse" very well and quickly, and both sent and read long telegrams the first evening they tried it, to the admiration of France and other old telegraphers on board.'

When the cable was all packed in again and the *Hooper* sailed away, a figure was seen at a high window in the Blandys' house, with a white scarf waving a message in Morse. 'Eh! What's that? What's that?' said Sir William, adjusting his eyeglass to read the signal. It was 'Good-bye, good-bye, Sir William.' That 'good-bye' brought him back again the following May in the *Lalla Rookh* to beg for the hand of Fanny, the second daughter of Mr. Charles Blandy. A letter to my mother says:—

'*Lalla Rookh*, FUNCHAL BAY, MADEIRA,
'*Tuesday*, *May* 12, 1874.

'MY DEAR ELIZABETH,—I believe you heard from Lizzie [Mrs. James Thomson] that I intended to sail from Falmouth for Madeira on the 2nd of May. The *Lalla Rookh* has done well—taken me to the island, 1200 sea miles from Falmouth, in 6¾ days. I anchored exactly at noon on Sunday in Funchal Bay . . . yesterday I was answered "yes" to a question I asked very soon after the English people came out of forenoon church on Sunday. I was here for sixteen days last June and July, on account of a fault in the cable. Otherwise this greatest possible blessing could not have come to me—that is as *we* see—but surely it is not chance.

'When I came to Madeira in the *Hooper*, it had never seemed to me possible that such an idea could enter my mind, or that this life *could* bring me happiness. I thank God always that I was brought here. When I came away in July I did not think happiness possible for me, and indeed I had not even begun to wish for it. But I carried away an image and impression from which the idea came, and before I landed at Dover in October I had begun to wish for it. Hope grew stronger till yesterday, when I found that I had not hoped in vain. . . . When you know Fanny you will be able really to congratulate me. Even now I think you will be glad for my sake . . .

'Your ever affectionate brother,

'WILLIAM THOMSON.'

A story has been circulated, and still appears from time to time in the newspapers, saying that Lord Kelvin signalled his proposal from his yacht, and received his answer from the future Lady Kelvin in Morse from the land. It sounds very interesting and romantic, but as every sailor on board and plenty of people on land could have watched and read the whole romance, it would be a bold man who would adopt such a proceeding.

The marriage proved a very happy one. Lady Kelvin was a woman of great presence and dignity, and with kindly qualities and a sympathetic nature, which made her a pleasant centre for the family to meet round. Lord Kelvin was very hospitable, and she was a splendid hostess, so that the gatherings under their roof were always delightful.

A letter from my mother in 1890 says: 'Yesterday there was an extremely pleasant dinner party. . . . Every day I admire Aunt Fanny more and more. She does the honours of her house with such kindly and generous grace. She puts every one at ease with her pleasant tact, and at the same time she is so elegant and dignified. She manages the house too, so beautifully, and all the servants do their work with such smiling good-will.'

Numerous distinguished guests enjoyed their hospitality, and many of all nationalities, who would otherwise have been very lonely, were discovered and invited to the house. A Japanese scientist had unfortunately to refuse an invitation to dinner because, as he said, he had 'no night dress' with him, and 'in this country I understand men must always dine in night dress.' Another was also prevented through being 'concealed in bed by a bad cold.'

Lady Kelvin was very correct, and her dinner parties were always planned with great precision and care. Once, however, when I was staying at the College her arrangements were upset by a German scientist of some distinction who, having been invited to a formal dinner party, arrived with his plain-looking and *not* over-dressed wife, whom none of us knew existed, and who consequently had not been invited. A quiet sign from Lady Kelvin sent my sister down quickly to rearrange the table as best she could. I, as the youngest, got no gentleman, and our new friend was placed next Lady Kelvin. The large invited party was exactly the size of the dinner service, and Lady Kelvin had the mortification of seeing the odd plate at each course given to the unbidden guest instead of to herself! After dinner a number of young people joined the party in the drawing-room, and a new game was produced, 'Hunt the scent-bottle,'—'a box containing a scent-bottle and crackers,' one of the crackers having the word 'scent-bottle' inside, while the others had mottoes. We were all handed crackers, then our cousin James Thomson walked round, pulling each cracker in turn and reading the motto aloud. When he came to our new friend's motto, he hesitated and got very red. 'What is the matter, can you not read it?' we all asked. It had to come out: 'Send us a post-card next time you are coming!'

My uncle was frequently delayed, and came hurrying in late for meals, and his parrot, Dr. Redtail, who was an important personage in the establishment and a remarkable talker, at once said: 'Late again, Sir William.' This was a great amusement, and we suspected Gray, Sir William's faithful butler, of having taught him. Once, however, when there was a party of distinguished guests, and my uncle was very long in appearing, my aunt suggested beginning dinner. As soon as every one was seated, Dr. Redtail looked round the table and inquired: 'Where is Sir William?' A little later, when the master of the house appeared, the bird shouted jubilantly: 'Late again, Sir William, old boy.' We glanced at Gray, who turned very pink, but I am sure he was innocent of this last addition.

Great as was the pleasure of these interesting gatherings, the dinners with only the family present were the happiest. Then the talk was general, and it was always lively as well as intellectual. Both my uncles possessed wit, and my mother had a fine gift of repartee, so the ball flew from one to another and never dropped. One of the most memorable of these family parties took place in December 1891; it was the last time my mother and her two brothers were together, and it was specially lively. The question of degrees for women arose, and Professor James referred to Anacreon's opinion of women. Lord Kelvin challenged him to quote, and Professor James immediately recited the whole ode in Greek, translating it for the benefit of the younger members of the family who were not so learned.

Lord Kelvin's post-bag was a very heavy one, much that was of real interest and importance, and a great deal of waste-paper, with an intermingling of the most extraordinary communications. Endless inventors wanted his consideration and his help with their marvellous discoveries. One man, for instance, could prove that both the sun and the earth were stationary, and he was most anxious to demonstrate the fact in an interview. As to relations, they bristled up all over the world; every Thomson or son of a Thomson was at least a half-cousin, and of course they all wanted money. These letters were always immediately consigned to the waste-paper basket; one, however, I rescued. Here it is:—

'PHILADELPHIA, P.A., CAMDEN, N.J. . . . etc.,
'*December* 17*th*, 1894.

'*To* Sir WILLIAM THOMSON,
'Glasgow, Scotland.

'MY DEAR RELATIVE,—No doubt you will wonder somewhat when you receive this, not knowing who the writer is, but I will tell you. I am son of the youngest daughter of Dr. Thomson of Union County, Pennsylvania, Margaret Sherrick, and my name is Harry.

'I have been working in an insurance office, and am old enough now to become a member of the firm, but have not enough money, so I thought I would ask you for a little help, as it requires a deposit; no doubt you will give a young relative a start. I like the business very much, and would certainly be very happy if you would give me the means to become a member. I will not tell you how much I want, but will leave that for you to decide how much you are willing to let me have. The firm I am working for now like me very much, as I have been with them for a long time.

'I will close now, ever hoping you will not be offended by my little request.

'Mamma, papa and sister all send their love to you and Mrs. Thomson.—Your loving relative,

'H. SHERRICK.

'*P.S.*—Would love to hear from you real soon.'

Endless advertisers of quack electric cures also wrote beseeching Lord Kelvin to allow them to use his name, and they were willing to offer any reward. From the silence of the waste-paper basket, however, they got no reply. One of these cases was taken into court, and Lord Kelvin was called by the suing party to give evidence as to whether a belt supplied was in any way electric. 'If,' he said, 'the belt could achieve all the wonders claimed for it, it would be the most remarkable thing ever invented; but, as a matter of fact, it could not even produce electricity.' The inventors lost their case, but in their next advertisements of the belt they put: 'To quote Lord Kelvin, "The most remarkable thing ever invented."'

Lord Kelvin's own postal communications were sometimes very original. The following unique invitation was sent by him on a post-card to Professor Tait, when they were collaborating. We were living at Napier Road, Merchiston, in Edinburgh, at the time, and my uncle was staying with us.

$\eta \quad \beta \quad \pi$

In the Logarithmic quarter
to-morrow Wednesday at 6-30 P.M.
W. T.

I had the posting of the card, and it was explained to me: I give it from memory, also the interpretation. John Napier, Baron Merchistoun, was the inventor of Logarithms in 1614, and the three Greek letters are Eta, Beta, Pi. I was only a child, but it left a very strong impression upon me.

GLASGOW UNIVERSITY AND THE RIVER KELVIN

Drawing by Agnes Gardner King

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CHAPTER VI

THE UNIVERSITY

In March 1873, to Lord Kelvin's great delight, his brother James was elected to the Chair of Engineering; so our family has had a long and close connexion with Glasgow University, and we have many happy memories relating to it. There was never anything dull about it. Both my uncles were very witty, and when there was any fun going they enjoyed it as much as any one.

Once at Professor James's house there was a party, and the young people were acting. Lord Kelvin was comfortably settled in an arm-chair, and apparently deep in his 'green book,' one of a series of notebooks he carried everywhere, and in which he made the most abstruse calculations. Some of the actors came in and elaborately prepared three beds. As soon as they left Lord Kelvin jumped up and, signing to his brother and Dr. Bottomley, he settled himself in one of the beds and the other two quickly followed. When the real patients arrived, all bandaged up, and led by doctors and nurses, they found their beds occupied by three miserable sufferers, moaning and groaning horribly, who had to receive instant attention.

In the scientific line, too, there was always some new surprise. It was delightful, when young, to find my uncle and his assistant blowing soap-bubbles at the top of the stairs, and watching them with their lovely colours float gently down, even if we did not know that by studying them he was hoping to be able to discover something of the ether spreading through space, which he believed to be the medium for the transmission of light; that with his marvellous measuring instrument he had measured the film and found it to be one twenty-millionth of a millimetre thick, and that the questions involved in the seemingly simple operation of blowing bubbles were amongst nature's greatest enigmas.

Spinning tops and pennies on the drawing-room table was also an entertainment, and we could all help my uncle with that; but we could not help him to find out why the top stood on its end and went to sleep—a problem which he had been trying to solve from childhood, when he and his brother spun their tops in front of their Belfast home, and which he did not succeed in solving for more than forty years.

Lord Kelvin possessed the most extraordinary energy; he was in the habit of breakfasting at half-past seven, till finally Lady Kelvin altered the hour, thinking it wise to shorten the long, strenuous day. He never failed to be down punctually, with all his faculties alive and bright, and, no matter who was staying in the house, the hour was not altered. Once a young man visitor came down late. Lord Kelvin was much surprised and remarked afterwards: 'That is a very strange young fellow!' I used to be very tired, for we did not go to bed early, and I remember making frantic efforts to be ready and down in time, and if I were a minute late, always finding my uncle standing gazing at the clock.

He had a wonderful mind; even when he was engaged in his most abstruse calculations he liked to be among us. As soon as his secretaries left, his step was heard on the stair, and he settled down in the middle of our little circle, 'green book' in hand, and soon seemed absolutely absorbed; but he heard all that went on. Once I was telling how I had been shaking and thumping my first watch to make it go, when he quietly remarked, without looking up: 'If a watch stops, scrub it well with a nail-brush and soap and water.' Another time, when he seemed very busy, we lowered our voices to discuss fashions. He looked up, saying: 'What is that? I did not hear.' We were obliged to confess we were speaking of a new style of sleeve. He was quite interested and wanted to know exactly what it was to be like.

He was perfectly able to carry on several different trains of thought at the same time, and yet be aware of all that was happening around. Once when I peeped into the study he was comfortably settled in an arm-chair, his ' green book ' open on his lap, a pencil in one hand and the other in the parrot's cage. Two secretaries were working for all they were worth, taking down at his dictation two totally different subjects, while he turned quietly from one to the other. ' Now,' I thought, ' is my opportunity of a little practice '—for my uncle was very fond of music and always asked for it in the evening. So, having carefully shut the study door and gone up to the drawing-room, which was not over the study, and shut that door also, I began to play very softly, confident I should not be heard. I had, however, only struck a few chords when there was a quick step on the stair, the door flew open, and my uncle's head appeared, saying: ' That Mozart is lovely. I am just opening the door to hear better,' and he was off again.

Lord Kelvin's love of music took him always when possible to good concerts, Joachim's Quartettes giving special pleasure. When at any function or reception there was a good band he could always be found near it, ' green book ' in hand, thinking out problems, and at the same time listening to every note. He required no grand performer, however; any one who was able to play pieces from the classical composers simply and sweetly could give him intense pleasure. Once when I went to stay at Netherhall, to recruit after a long illness, the very first evening the piano was opened, but both it and I were rusty. Next day was warm and sunny, and my uncle elected to work in the garden, so all his papers were carried out, and before going for a drive Lady Kelvin settled him most comfortably. I was determined to improve the precious moments and, having shut the drawing-room window, I began to practise. Immediately, however, the door opened and he appeared, with his books and papers bundled up under his arms and scattering as he walked, remarking: 'I heard the music, so not wanting to miss it I have come to work in here.'

He had his own views about music, however, and had no liking for the modern composers; Beethoven, Mozart, and Weber were among his great favourites, while Grieg he hated. Once I tried to trick him with a very sweet little Grieg inserted between other music. But he was too quick for me and remarked: 'You very cleverly showed the remarkable contrast by placing that Grieg between Beethoven and Mozart.'

Music had a very soothing effect on him; so much so that in 1905, when he was suffering very much and on the eve of a serious operation, Lady Kelvin sent for my sister and me to play to him. He had not been able to sleep, and looked tired and distressed, but he was delighted to see us, and settled down in an arm-chair, while we played his favourite Weber and Beethoven duets. Gradually the look of suffering disappeared and he dropped into a quiet sleep.

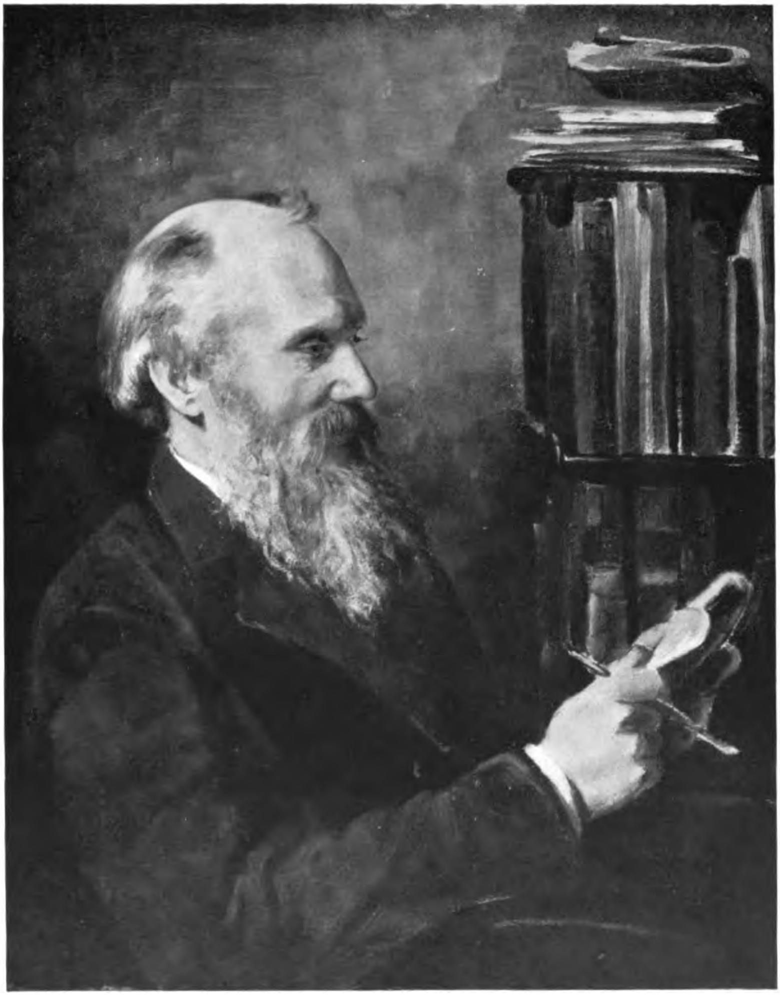
His love of music extended to the education of his parrot, Dr. Redtail, to whom he gave singing lessons. It was most amusing to listen, Lord Kelvin was so enthusiastic and the bird so appreciative. Dr. Redtail had a very good ear and quickly picked up the beginning of an air, but he had not Lord Kelvin's patience, and 'The Quaker's Wife,' which the bird always treated as a part-song with his master, was the only thing he ever perfected. This, however, gave great satisfaction. In a letter of mine, Dec. 17, 1891, I find: 'After tea Uncle William took me down to see Herkomer's portrait of him, and when the light was turned up poor little Dr. Redtail thought the visit was to him, and was immensely pleased. He has a very gentle voice, and began at once to whistle "The Quaker's Wife." I asked if he could whistle the whole of it. "Oh, yes," said Uncle W., "but he likes best that we should whistle it together bit about." Then Uncle W. whistled a bar and the parrot took it up, and Uncle William remarked: "Now you see he expects me to finish it," which he did. This little musical performance in two parts was repeated two or three times, and Uncle W. *did* look so very nice.'

A letter from my mother, dated 6th Nov. 1887, tells a little more about Dr. Redtail's singing lessons: 'When I arrived here yesterday, Uncle William and Aunt Fanny met me at the door, Uncle William armed with a vessel of soap and glycerine prepared for blowing soap-bubbles, on a tray with a number of mathematical figures made of wire. These he dips into the soap-mixture and a film forms or adheres to the wires very beautifully and perfectly regularly. With some scientific end in view he is studying these films. I was at once taken into the study to see them, and while Uncle William was showing them to me, and giving me such explanations as I could take in, he was teaching Dr. Redtail to whistle "Merrily danced the Quaker's wife"—Dr. Redtail being in the dining-room, and the teacher and pupil carrying on the lesson at the top of their voices. The whole evening was occupied with the soap-mixture, the wire figures, and the tobacco pipe, while Aunt Fanny read aloud Mr. Balfour's speech.'

Classical music was even attempted, and an endeavour made to teach the bird 'The Pastoral Symphony.' Dr. Redtail enjoyed the lessons immensely, but Lord Kelvin was obliged to acknowledge defeat, and in a letter he said: 'I am afraid I cannot prevent his mixing it up with other things.'

A good picture of my uncle in his study is given in a letter from my sister, the late Elizabeth Thomson King, describing the painting of his portrait, now in the National Portrait Gallery: 'To-day I had what is called a sitting from Uncle William, lasting from 10 till 2. But it is a very lively sort of a sitting. He dictates to his secretary, studies his "green book," receives visitors of many and various kinds, jumps up and holds conversations with the people in the laboratory through the telephone, reads the newspaper aloud, etc., etc. I am afraid that to-day I have got a little muddled among the various expressions of repose and animation, so I have grave doubts as to the ultimate success of the portrait. So far I do not think Uncle William finds it at all irksome, for he is getting through a lot of work which would otherwise have been put off and off he does not know till when.

'We had a merry evening last night. Professor Drummond, author of *Natural Law in the Spiritual World*, was one of the guests. He proposed thought-reading as an entertainment, and Uncle William entered most heartily into the fun. Uncle William was to go and hide something in a dark room, and then to return and think about it very hard, while Mr. Drummond went to look for it. Mr. Drummond was supposed to be acted upon by Uncle William's brain, and it was exceedingly funny to see Uncle William first gravely going through the process of holding two of his fingers on Mr. Drummond's head for a certain number of seconds, in order to bring about the necessary magnetic conditions between them, then hiding the ring with a number of witnesses to help him, and to guard against deception, and finally setting himself resolutely to "think hard," while Mr. Drummond went to make his search in the dark study. The experiment was very successful. Then it was tried the other way,



LORD KELVIN IN HIS STUDY

From an oil painting by Elizabeth Thomson King
now in the National Portrait Gallery

Mr. Drummond thinking while Uncle William looked. We were all exceedingly puzzled. I had the hiding of the ring with Uncle William once, and I saw no sign pass between him and Mr. Drummond, yet the ring was found directly. This morning Uncle William told me the secret when I was painting him. After the ring is hidden and the room darkened, the person who is to "think hard" and direct the movements of the seeker very quietly and gently deposits his watch beside the ring, and the ticking is the real guide. Certainly Uncle William acted his part capitally, and greatly enjoyed the bewilderment of the company.'

Among the recurring events in the University there is none more exciting than the election of the Lord Rector. In the following letter to me my mother gives a vivid account of the proceedings :—

'THE UNIVERSITY, GLASGOW,
'*November* 15, 1887.

'MY DEAR AGNES,—The election of the Lord Rector is going on and there is a great commotion all round the college. At present from the upper study window I can see in the Bute Quadrangle rows and rows of red-gowned students.

'*Tuesday*.—I got so far yesterday and afterwards we had a very lively day and evening. The excitement about the election became very wild, procession after procession of reds (for Lord Rosebery) and blues (for Lord Lytton), headed by a couple of pipers in kilts, marched round the courts, and as they passed the house halted to hurrah for Sir William. The blues cheered lustily each time, but the reds did it only once, and it showed his great popularity that they did this much and did not *Hoot* rather every time they made the round. Besides *processing*—to use a new word now in vogue—each party had huge waggons (like what we saw at the carnival in Rome) drawn by four milk-white horses in which students brandishing flags were clustered like a swarm of bees and cheering and singing and howling, drove out and in everywhere about the College, taking off their caps as they passed our house. At length the votes of the four nations—Glottiani, Rothsayani, Loundoniani, and Transforthiani—were taken and counted, and the Principal, surrounded by the professors, or at least a great many of them, announced the result from the balcony to the crowd below. It was a tie—two nations on each side—so the decision rests with Lord Stair, the Lord Chancellor of the University.'

The Great Bazaar in 1889 was another event and one of very considerable importance. It was got up for the Students' Union, and was held in the Bute Hall. A profit of £11,000 was realised, and at Lady Kelvin's stall alone £2000 was taken. It was a great upset to Lord Kelvin, as it was found necessary to make a passage through his laboratory—a serious hindrance to his work, besides greatly endangering his instruments. A letter from my mother, dated 14th December, gives a vivid account of a visit to the laboratory at the time :—

'On the way we looked in at the Laboratory where there were many students at work, and where Uncle William was eagerly giving directions to a man (I suppose from White's) about instruments, and at intervals calling to men who were boarding a passage through the laboratory for the use of the bazaar. His words tumbled out like a torrent: "Take care, let nobody get through among the instruments. . . . Board up close and strong," etc. It is really a very anxious thing to let a crowd pass through among such valuable instruments, and where such delicate experiments are in progress. His work already is greatly impeded and much will be long stopped, and some he fears spoiled. It has been quite a trial to him that a passage was wanted through his precincts. In the midst of all this he spied me and beckoned me, and explained to me his new multicellular voltmeter. I understood his explanation to a great extent, and I may tell you that it is most wonderful and beautiful. Then he took me to another place and showed me a new electrometer, and to a third place and showed me a small and very precious instrument for the most delicate measurements. This one, he said, required very great care in its use. I forgot to say that by the first you can say how many lights are going ; if one be put out, or if an additional one be lighted, it tells, and he showed me the action.'

The bazaar was a very gay affair; the lady stall-holders were magnificently dressed, the place was decorated, and the stalls were sumptuous. Lady Kelvin was very busy at her own stall, and Lord Kelvin walked up and down with my mother on his arm, talking genially to every one. His purchases did not help the cause greatly, but they were much valued, for he bought specially for me two pretty little vases, and he bought for my mother a Chinese toy with which he fell absolutely in love—a little man and wife with sticks in their hands, who, when a squeaker underneath was pressed, started fighting. This he exhibited to every one, and I think he must almost have regretted parting with it to my mother. My mother had a very happy day, and several friends wrote afterwards telling us admiringly how very bright and charming the brother and sister looked together.

CHAPTER VII

THE ATLANTIC CABLE

Lord Kelvin's interest in electricity was very early excited. In 1848 he spoke of its immense possibilities for usefulness and of his surprise that so little attention was paid to it. He said there was no branch of science that afforded a surer foundation for the application of mathematical reasoning. He was himself no party to this neglect. All his life it lay at the root of all his experiments and work, and of all his hopes and aspirations; yet at his Jubilee in 1896 he said sadly: 'I know no more of electric and magnetic force or of the relation between ether, electricity, and ponderable matter . . . than I knew and tried to teach to my students of Natural Philosophy fifty years ago.' But in the course of his study he reaped a rich harvest for the world. Sir J. J. Thomson says: 'Modern wireless telegraphy, telephony, and broadcasting depend upon a result published by him in 1853, which was, that in an electrical circuit containing capacity and self-induction the motion of the electricity is oscillatory when the resistance is not too great, and that the time of vibration is proportional to the square root of the product of the self-induction and the capacity. This fact is the basis on which all transmitters and receivers of wireless are tuned.'

The following extracts from letters to my father and to my mother are interesting in the present connexion:—

'*March* 1861 . . . I am glad you are interested in some parts of my paper on "Atmospheric Electricity." It is merely an abstract and necessarily very condensed, but so far as the details of instruments and electric observations are concerned it will not be less acceptable on that account. I am afraid you say more than is deserved as to the style; but one thing is certainly true, that I in general get on at a very slow rate in writing for the press.'

'*February* 1885.—I am just now and indeed have been from the beginning of the session hard at work on a new set of measuring instruments for electric potentials and currents, to meet modern practical and scientific requirements. I have been for four or five years trying for something of the kind—getting something made and brought into use to partially supply the want, but it is only since last May that I have got on the right plan, and now I am just on the point of getting several different instruments to do much more complicated [work] than even what is wanted.'

It was my uncle's instruments that made long-distance telegraphy possible. Till he grasped the subject, a cable to America was looked upon as 'a mad dream.' The one idea of cable work was to get more and more powerful instruments to force the message through a cable, but it was not possible to get a cable which could endure such strong currents as were required for considerable distances. Lord Kelvin, on the other hand, brought his mind to bear upon an instrument which should be able to respond to the faintest possible electric current. The mirror-galvanometer was the result. Inside, a tiny magnet made of watch-spring is attached to the back of a minute convex mirror, the whole weighing only a grain and a half, and it is hung in the centre of a coil of very fine wire. A lamp directed on the mirror reflects a tiny spot of light on a scale, and as the electric current deflects the magnet, so the light moves to right or left, and the message is carried in Morse.

I think this was my uncle's pet instrument. I remember that it accompanied him on several visits, and being told how wonderful it was, and that I must not shake the table or run about near it.

To me it had a special interest because of learning that my uncle's little dog, Fairy, supplied from his coat the delicate fibre which suspended the mirror, my uncle having been unable to find anything else fine enough for the purpose. Once, when he was staying with us, the fibre broke, and he was in great difficulty till I produced one of my silkworm cocoons, and wound off some of the silk. To my immense gratification it proved exactly what was wanted, and after this I had the delight of being applied to regularly by my uncle for fresh supplies. It also came in useful for several other instruments; moreover, cocoon silk is still used for such purposes.

Watching the spot of light was a great strain; also there was a liability to mistakes; so Lord Kelvin's busy brain devised the Syphon Pen, by which the cable wrote its own messages. The pen was made of hair-like glass tubing; it did not touch the strip of paper which was mechanically carried past, but a little instrument, called the mouse-mill, electrified the ink and forced it in a fine spray through the pen.

It was most interesting to watch my uncle when bringing his invention to perfection, with his skilled hands deftly manipulating the delicate tubing, and bending it into shape with the heat from a lighted match.

The wonderful dexterity with which Lord Kelvin and Professor James Thomson were able to carry out their inventions was due greatly to their wise father, who had provided them with accommodation and conveniences when they were mere children, and encouraged them to make things for themselves instead of supplying them with ready-made toys.

The Mirror-Galvanometer was superseded by the Syphon Pen for submarine telegraphy, but the galvanometer is still one of the most useful instruments in the laboratory, and it was of immense value during the war to locate submarines and other vessels, and to tell the direction in which they were going. A cable in a zigzag pattern was laid over the bottom of the sea, and as an iron or steel vessel passed over any part of it, the mirror in the galvanometer, safely lodged and carefully watched at home, was deflected and gave up the secrets of the deep.

The laying of the first cable to America was a matter of overwhelming excitement. On 29th May 1858 the expedition started. My uncle was almost the last man on board. His all-important galvanometer had not arrived yet—would it come in time? Its construction had only been begun a fortnight before—was it ready? He paced up and down, watching and waiting in a state of intense anxiety: at last to his joy Donald MacFarlane, his assistant, arrived by express with a small object like a brass pot standing on four legs, and put it in his hands—the Mirror-Galvanometer!

Charles Bright, afterwards knighted for this work, had been entrusted with the making and the packing in of the cable. Little does the ordinary individual understand what such work involves. In the construction of the first Atlantic cable 340,500 miles of fine wire were used, enough to go thirteen times round the world, and considerably more than would be needed to reach the moon! The whole of a cable in process of construction must be tested from end to end to see that there is not a single flaw; then it has to be packed in the hold of the vessel. This last is a matter of great concern and difficulty. Unfortunately a terrible storm was met with not far from home, and the cable was seriously displaced and damaged. My mother has often told me of the awful suspense lest the vessel had gone down when, after the storm, the cable ceased speaking. It is impossible to realise the tension and, to use Lord Kelvin's words, 'harrowing anxiety' on board; no one seemed to breathe freely. A diary written at the time by the late Nicolas Wood, speaks of 'Dr. Thomson, in a perfect fever of nervous excitement, shaking like an aspen leaf, yet in mind clear and collected, testing and waiting with a half-despairing look for the result. . . . Mr. Bright looking to the professor for advice. . . . Round the door crowded the sailors of the watch, peeping over each other's shoulders. . . . The eyes of all were directed to the instruments, watching for the slightest quiver indicative of life. Such a scene was never witnessed save at the bedside of the dying. . . . We looked at each other in silence. . . . Suddenly one sang out "Halloa! the spot has gone up to 40 degrees." The clerk at the ordinary instrument bolted right out of the room, scarcely knowing where he went for joy, and cried out: "Mr. Thomson! the cable 's all right." Our joy was so deep and earnest it did not suffer us to speak for some seconds. . . . Never was more anxiety compressed into such a space. . . . The only instrument that kept us from despair was Dr. Thomson's. . . . On the night of 3rd August we got into shallow water. About ten Dr. Thomson came into the electrical cabin, evidently in a state of enjoyment so intense as to absorb his whole soul. . . . He then proceeded to congratulate those present on being connected with such an expedition.'

At last the great task was accomplished and the American end landed, ladies, unmindful of tar on their white hands and gloves, helping to haul it ashore. America went almost mad with joy when, on the ever memorable 5th of August 1858, the message rang across the Atlantic—

' Europe and America are united by telegraphic communication. Glory to God in the Highest, on earth peace, good will towards men.'

The injury, however, had been great, and the cable gradually ceased to work; but the fact had been definitely proved that a practicable cable could be laid to America, and later, in 1866, the task was accomplished, and telegraphic communication with America secured—not, however, without the most strenuous efforts on Lord Kelvin's part.

Along with his professorial work and his many other duties, he gave earnest study to submarine telegraphy, inventing a number of new instruments, and hurrying back and forwards to London to superintend the making of the cable. A place was always reserved for him in the London Express; and not infrequently, when some instrument was not quite ready, his secretary was sent hurrying to the station with the message: 'The London Express must on no account start to-night till I come,' and the national importance was so great, and such was the honour in which Lord Kelvin was held, that the stationmaster obeyed.

No effort on his part was too strong, no toil or sacrifice too great, to accomplish the end which seemed to him to have an almost sacred importance. In 1906 he spoke of electricity as a peacemaker, and of the great dream of his life, which he hoped it might some time help to realise—'Universal peace, universal alliance, among the nations all over the world.'

Our house was his London home during this time. He had a latchkey, and he walked in at any hour of the day or night. His bed was always made and his room kept ready; and any morning when we came down to breakfast we might find him there, one of the family. Once when he arrived in the middle of the night, after dismissing his cab he found he had no key. He could not at that hour pick up his heavy bag and go in search of an hotel, his ringing was not heard, and he tried to climb up and get in at the window, but in vain. My mother was a light sleeper, and at last her attention was aroused by the unusual sounds and his call of 'Elizabeth,' and she came down and let him in.

These frequent little visits of his, hurried and busy as they were, gave her and all of us the greatest pleasure.

My uncle was knighted for his services, and Glasgow conferred the freedom of the city upon him. His speech on the occasion was marked with characteristic modesty. 'I find it impossible to give any adequate expression to my feelings in receiving this distinguished mark of the generous consideration with which my fellow-citizens have, from the commencement of the undertaking, regarded my connexion with the Atlantic Telegraph. . . . How highly I value the privilege of being enrolled in the list of your burgesses I cannot find words to tell; but I can only say that, as long as I live, it will be a stimulus to me to endeavour so to act as to do no discredit to the ancient and famous city of Glasgow.'

There is a certain amount of danger connected with being a famous electrician! In a letter of my mother's from the University, she says: 'On Friday afternoon five big stones were thrown through the study window, and four panes of glass smashed as well as a fern-case. It turned out to be the deed of a maniac, who gave as a reason for the mischief he had done that Sir William was a villain who had rained electricity on his head. He has been sent to an asylum.'

The success of the Anglo-American cable led to much further telegraphic activity. In June 1872

Lord Kelvin wrote to Helmholtz: 'There is now a great telegraph project in the course of execution to lay cables from England to Bermuda and then to New York and St. Thomas. The manufacture of the cables has commenced, and Fleeming Jenkin and I being engineers to the company are obliged, one or other of us, to be very frequently in London. We have a great deal of electric testing to do—insulation, electrostatic capacity, and resistance of the copper conductor, also testing the strength of the iron wire and of the finished cable. The laying will not commence till this time next year. I am chiefly on board the *Lalla Rookh* off the South of England, and coming up to London when necessary. I can only get mathematical work done in the yacht, as elsewhere there are too many interruptions.'

Both at Millwall and at Mitcham, where the cables were being made, a staff of electricians had to be kept at work, and my brother, David Thomson King, was put at the head of them. He was only nineteen at the time, but he was a young man of unusual ability, and there was every hope that he would follow in his uncle's footsteps; for he had great originality and mathematical talent, and he had also Lord Kelvin's sweet simplicity, and the same bright engaging graces which made him also a universal favourite. My uncle regarded David as a son, and while he was going through his course at the University he lived in my uncle's house and was a pleasant companion, cheering his widowhood.

Sir William, coasting round in his yacht, was able to drop in at any time at the works, where he always found everything as satisfactory as possible, and in a letter to my mother says: 'David is doing very well indeed.'

I was taken to see the works, and was extremely proud of my brother, in command, directing everything with quiet dignity. The whole thing was most impressive, miles and miles of cable, wheels great and small revolving with a deafening whirr, making it impossible to hear our own voices. David was too busy to talk, however; he could not divert his attention for a moment from the supreme task entrusted to him. Suddenly he detected a fault and raised his hand. It seemed like a magic spell; instantly the roar and the din ceased and there was silence. All the giant machines were still, and they could not start again till he gave leave.

In June the following year a letter from my uncle to my mother says: 'He (David) is not to go out in the *Hooper* this trip, but will remain in charge at Millwall. This, I think, will be better for his progress afterwards than going to sea just now would have been, as it makes him known to Mr. Heugh and others as holding a responsible position.'

In 1874 David was put in charge of the electrical department in the laying of a cable to Brazil. There was disaster from first to last. The start was delayed by the vessel breaking from her moorings and drifting off while taking in the cable. The vessel had to be captured and the broken cable spliced before she started again, on the 15th of February.

The following quotation from a letter of David's to my mother shows some of the difficulties to be contended with in tropical cable-laying: 'Papa will be interested to learn that six faults were caused in the cable from Pará to Cayenne by the bites of fishes. The teeth penetrated between the iron wires of the sheathing and through the indiarubber to the conductor. In several instances teeth and portions of teeth were found sticking in the cable. The fish were of different kinds. It is supposed that such accidents will occur at first. In a few days the cable will be overgrown with seaweed in the tropical seas. In the Red Sea communication was several times interrupted by snapping turtle.'

The following quotation from a long letter of 22nd April tells of the most exciting adventures and hairbreadth escapes in the first effort to land the cable:—

'During the laying K. and I have very hard work. Sometimes we are on duty for twenty hours out of the twenty-four, observing the sun and stars, finding the ship's place, taking soundings, seeing how the testing is being conducted, etc., etc. . . .

We got to Santa Catharina on Saturday evening. Next day was Easter Sunday, but no regard is paid to Sunday on board ship when there is anything to be done. It would be too expensive, for the vessel costs some £300 a day. It was blowing half a gale and the wind was right on shore. There is nothing to break the waves between the South American coast and Africa, so they were very large, and though we were a mile and a half from the beach we heard the roar of the surf like thunder. It was impossible to land the cable under such circumstances, but not to lose time Mr. R. wished if possible to get ashore to examine the beach and land a rope to be used afterwards in landing the cable. The life-raft was got out. The sailors hung back, but a crew of volunteers was formed: I was one of the number. We got on very well till we came to the surf, though we were made uncomfortable by seeing the fins of a shark swimming round us. When we got close to shore we (some of the party) jumped overboard and swam. When I began to swim I found I had a long way to go. Just as I gained bottom I heard a cry for help, and looking round saw Mr. J. drowning a good way out to sea. I called the doctor and then set out to get at Mr. J. But when two-thirds of the way was passed I found I had no more strength. The breakers were terrible—they hurl you back and bury you each time one passes. I was afraid I should not get to land myself.'

The doctor managed to rescue the drowning man and to bring him ashore: but it was impossible to reach the raft again, and it had with difficulty to make its way back to the ship, leaving the drenched and exhausted little party of swimmers on shore, and the vessel very nearly had to put out to sea without them. After, however, adventures with snakes and a night in wet clothes, the wind fell and rescue was effected, signals from the ship indicating a spot at some distance from which they could be reached.

The next letter, dated 2nd June 1874, brings worse news: 'I suppose the news of the total wreck of the *Gomos* will reach you some weeks before the arrival of this letter, as it was telegraphed from Pará, where it just caught the mail. We are all alive and well. No lives were lost. We have been kindly treated by the Commandant and the Brazilian officers at the Bar, near the scene of the wreck, and by the English residents here at Rio Grande.

'The vessel struck at half-past eleven at night on 26th May. We were steaming about, as it was too rough for the vessel to ride at anchor. . . . We could hear the roar of the breakers, which were close to us on the port side. The engines were set full speed astern, but the ship still drifted on, impelled by the wind and the waves, and constantly bumping on the sand . . . we then began firing guns and sending off rockets. The rocket-sticks were nowhere to be found, and we had to improvise them; we used umbrellas and walking sticks. . . .

We waited anxiously for morning. At daybreak we found we were not on the sand but on the mainland, with about three-quarters of a mile of surf between us and the beach. There were a crowd of people with a life-boat on the sands.'

The wild state of the sea made the first attempts at rescue no easy matter, and required great bravery on the part of the rescuers: some of the men, indeed, including my brother, were not got off till next day, and another night was spent on the lost vessel. To continue the narrative from the letter: 'The men were got on shore with some difficulty on the life-raft. Each voyage, however, was easier than the last, as the ship was driven further up on the sand and the sea was becoming calmer. Next day we were able to send all the personal luggage on shore, and those who had allowed others to land before them got ashore dry. The cable and the ship are insured.'

A new cable had to be made with the greatest dispatch; and David was again hard at work superintending and testing at Millwall. He was, however, allowed a few days to visit us in Switzerland, and it was a very precious time. Every one, even the passing stranger in the hotel, was struck with his noble, manly appearance. All he had come through with such courage seemed to light up his face with a beauty that was not of this earth.

We were never to see him again. God had been preparing him for higher work above.

Once more the cable was ready; and on the 25th of November 1874 the *La Plata* started, with David in charge of the electric department. Four days later, when the Bay of Biscay was reached, storm clouds gathered and a fearful tempest broke. There was a wild fight with the elements, the great sail was rent from top to bottom and flapped in the wind, while the waters swept over the doomed vessel, flooding the engine-room. A second time the cruel waves lashed a hapless cable ship, and the ocean claimed it for its own. With a noise like thunder the *La Plata* and its precious burden sank in the deep.

There were only fifteen survivors, who had managed to get away in a boat and were rescued. One of these saw David just before the vessel sank, with a bright face trying to save others, and making no effort to save himself. He had no fear; he knew he was safe, whatever happened. When my mother asked him what he had felt during the long two nights on the wrecked *Gomos*, 'I was not afraid,' was the quiet reply. 'Because you trusted in God?' An earnest 'Yes' was all he said, but it was enough to be of immense comfort to us all afterwards.

Lord Kelvin felt the blow very much, and he was full of sympathy for his sister and for my father, who was then a great invalid. He wrote constantly, trying to send some little word of consolation, and his letters were of much comfort and help to my stricken mother. One of his letters says:—

'COLLEGE, GLASGOW, *Dec.* 14, 1874.

'MY DEAR SISTER,—You may indeed, as you say, count on my love and sympathy as a brother, and feel that I am with you in this great sorrow. I know well what you have lost, and can almost imagine how much it is to you. I have a most lively and grateful recollection of David as he was when he was with me in the house, and of all his subsequent life, so full of brightness and promise, and I recollect well, too, his brightness and sweetness as a child when I used to be with you sometimes in St. Peter's Terrace, and he and Agnes helped me so cheerily with the papers in the Indian Telegraph examination. I feel that it is a most sad loss to myself, and one which I share with you and his father. I cannot put in words how much also I feel for you and him and the girls under this terrible blow. . . .

'David did his duty nobly to the last. . . . I send by the same post a *Glasgow Herald* of the 4th December, in which you will see some particulars given which even to those who did not know any of us must be very touching.'

So passed a bright light out of our lives. One of the professors at Greenwich Naval College, who saw a good deal of David, said of him that he had had much experience of young men, but had never found any one to equal him in talent, and that the loss was a national one.

CHAPTER VIII

RECREATIONS AND NETHERHALL

It is difficult to say exactly what were Lord Kelvin's recreations: he found pleasure in his work, and work in his pleasure; and he never indulged in what any one else would have called a holiday. Games, however, such games as he did play, he thoroughly enjoyed, with a sense of complete rest, and with no effort whatever to exert his brain or use his memory. How he could in this way find pleasure in whist was a great puzzle, but he did, and a great deal of pleasure too. He frequently revoked, and he had often to be reminded which were trumps. Lady Kelvin always took him for a partner, because she knew his ways and they did not trouble her.

Sir Charles Bright, in 1889, speaking of the laying of the Atlantic Cable in his Presidential Address to the Institution of Electrical Engineers, makes an amusing reference to the whist: 'As to the Professor . . . he was a thorough good comrade, good all round, and would take his turn at the wheel of the paying-out brake if others had broken down. He was also a good partner at whist when work wasn't on; though sometimes, when momentarily immersed in cogibundity of cogitation, by scientific abstraction, he would look up from his cards and ask: "Who played what?" '

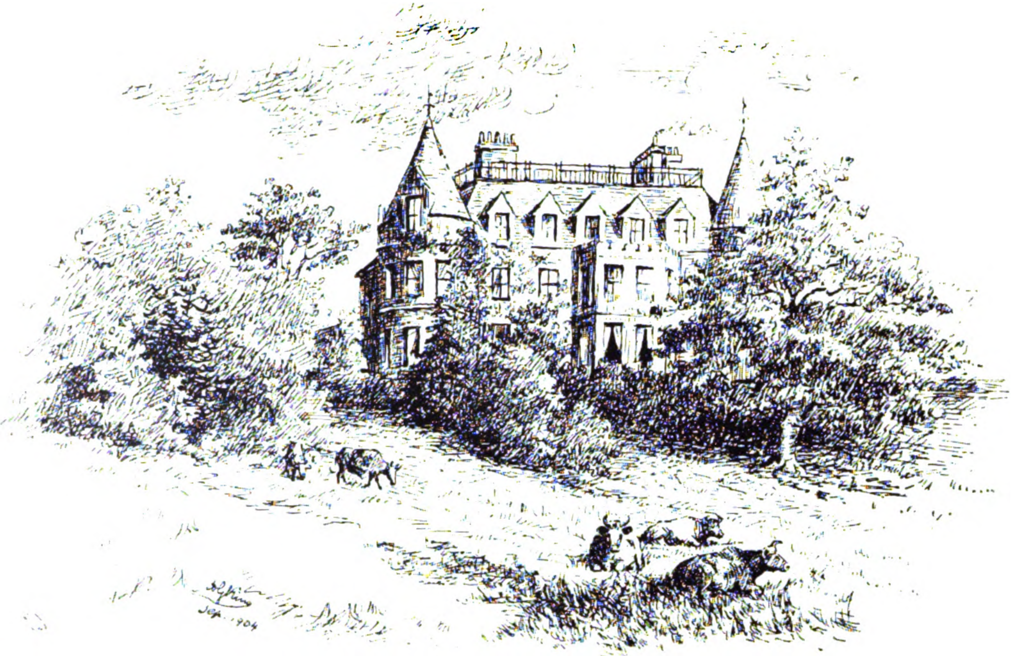
Once a gentleman from Holland, a M. du Boix, was staying at Netherhall when I was there. He was a keen whist player, and after dinner when whist was proposed he was delighted, and expected a very good game with Lord Kelvin. He got his first surprise when my uncle turned to me and said: 'Agnes, will you go to the piano and give us some music while we play.' Over the piano I could watch the game and our guest's face; it was most amusing. It expressed utter astonishment the first time Lord Kelvin, with half his mind on the music, calmly took back a wrong card he had put down; the second time a similar mistake occurred there was provocation and a look at me which said: 'I wish you would stop.' Soon, however, suppressed amusement took the place of any other expression, and the game was looked on as a joke and enjoyed accordingly by all the players.

When a large party of us was gathered at Netherhall we had very lively evening games, my uncle joining into our great delight. 'Word-making and word-taking' was specially entertaining, he entered into it with such gusto and got quite excited, making us all laugh by calling out entirely wrong spelt words.

Netherhall was built at Largs in 1875, and was a great joy to Lord Kelvin; he loved it, and indeed so did all who enjoyed its hospitality. It was most comfortable and home-like, and there was always a feeling of peace and welcome about it. To me it was altogether most attractive, but some people thought it might have been more beautiful. At a reception in Glasgow, when the house was just finished and was being much discussed, one of the guests remarked to Lady Kelvin, not knowing who she was: 'I have just made a dreadful mistake. I remarked to that gentleman over there that I could not think what the architect was about to let Lord Kelvin build such an ugly house. "I am that architect!" he said.'

Lord Kelvin did a great deal of his most important work at Netherhall, yet there was always a certain holiday feeling, and not such a sense of pressure as in Glasgow; and he indulged in a good deal of fun. An old letter of mine written in July 1888 gives a lively picture of Lord Kelvin in holiday mood:—

'On 31st July 1888, Catharine Henderson and Mary Henderson (Mrs. William Henderson) came to tea. After tea Uncle William proposed that we should all go up and see the view from the roof, and that Mary H. and I should go up in the lift. Mary Thomson ran up to pull from above, while Uncle W. pulled from below. We jumped in on condition that Uncle W. should allow us to pull him up afterwards. As soon as we were out at the top, we sent down the lift and waited for Uncle William to get in. "All right," he shouted from



NETHERHALL

From a drawing by Agnes Gardner King

below, and the two Marys pulled away as hard as they could. "It is pretty stiff work," said Mary H. "Uncle William is heavier than both of you," said Mary T. He got heavier and heavier, and at last when he shouted up, "How are you getting on?" his horses were obliged to confess that he was pretty heavy. He replied with a laugh that he had never been in at all. This caused much surprise, and as soon as he had run lightly upstairs and joined us he was closely questioned as to how an empty lift could be heavier than a full one. After puzzling us a little, he let out that he had been diligently pulling the reverse ropes, while the young ladies were exerting all their strength for nothing!'

Reference has several times been made to Lord Kelvin's light step, or quick step, yet he was distinctly lame, due to an accident while curling in Arran. I was little more than a baby when it happened, but I have been told how terribly upset I was to see my beloved uncle afterwards hobbling about on crutches, and how I offered him my tiny little hand to help him, and indeed pressed it upon him! I can distinctly remember my feeling of almost violent sympathy and distress. Owing to the remote locality, the leg could not be properly set at once, and it stiffened and shortened a little. It did not, however, inconvenience him; he could take long walks and move quickly and easily, and he remarked, himself, that he did not think any one would notice his lameness. It could not fail to be noticed, however; but there was something so completely lovable about him that any characteristic seemed to partake of it, even his slight halt.

Lord Kelvin loved children, and it pleased him to have them about him. I remember, when I was a small child some four years old, spending a whole happy morning helping him to sort his examination papers. My older brother David and I had settled down beside him, content with a smile now and then; but soon he proposed that we should help. We were ready and eager at once, and he gave us each in turn a paper, directing us where to lay it. We went straight on, absolutely happy, till early dinner, and the joyful climax came when he told our mother we had been really useful. He remembered the incident long after and more than once spoke of it with pleasure when I was grown up.

The following quotation from a letter of January 1874 to my father gives an idea of what examination papers, such as we helped to arrange, amounted to: 'I should have written sooner, but I have been absolutely overwhelmed with examination papers, answers to our printed questions for the "Mathematical Tripos," that is to say the Cambridge University examination for Mathematical Honours. The work is exceedingly interesting, but most laborious and wearisomely plodding. For my share of one sitting of the candidates I got 10½ lbs. of papers of written answers. I have had seven such hauls, and scarcely any of them less than 5 lbs.'

My uncle delighted in the young midshipmen on board the men-of-war he visited. They gathered about him, considering themselves his very particular friends, and they were always ready to give him advice and assistance! The following is a quotation from Lord Fisher's *Memories*: 'The midshipmen idolised Lord Kelvin, and they were very intimate with him. I heard one of them, who was four-foot-nothing, explain to Sir William how to make a magnet! Sir William listened to the midshipman's lecture on magnetism with the greatest deference, and gave the little boy no idea what a little ass he was to be talking to the greatest man on earth on the subject of magnetism. The same little boy took the time for him in observing the lighthouse flashes, and Sir William wrote a splendid letter to *The Times*, pointing out that the intervals of darkness should be the exception and the flashes of light the rule in a lighthouse, whereupon the Chief Engineer of the Lighthouse Department traversed Sir William's facts. The little boy came to Sir William and asked him if he had read the letter, and he hadn't; so he told him of it, and then asked Sir William if he would like *him* to write to *The Times* to corroborate him! Sir William thanked him sweetly, but said he would take no notice.' My uncle's advice, however, was taken and the flashes were altered.

Animals Lord Kelvin was also very fond of. His own parrot has already been mentioned. We also had a parrot—Dr. Hookbeak, a wonderful talker, given us by Lady Kelvin's brother—in which he took great delight. Our bird loved him and called him by name, as he did all of us, and he was always ready to ventilate his newest sayings when my uncle appeared. When Gladstone's Home Rule Bill was filling Lord Kelvin with distress, thinking it would amuse him, my mother taught the bird to say: 'Welcome Lord Kelvin. Down with Home Rule.' Next time my uncle appeared, Dr. Hookbeak called him by name as usual, then sidling up to the edge of the cage he said with great cheerfulness: 'Welcome Home Rule.' Lord Kelvin was really quite distressed and said: 'Oh, don't let him say that, he *must* not say that!' Dr. Hookbeak could be very impertinent. Once, when Lord Kelvin and Mr. Peter Graham and other distinguished guests were having tea at our house, and my uncle was talking, the bird called out: 'Lord Kelvin, Lord Kelvin, shut up.'

My uncle's little dog, which lived at Netherhall, never being subjected to the discomfort of town life, was a source of much pleasure and amusement to him. The dog was rather phlegmatic and not at all demonstrative. Once, however, I remember his climbing on to Lord Kelvin's knee and curling up there uncomfortably. My uncle was much pleased, and remarked that it must be sentiment on the dog's part, as his own basket was so much more comfortable. That he should acquire chivalrous manners was a matter of concern with his master; the dog, however, insisted on pushing in first at the door, and never waited for the ladies to pass. Lord Kelvin remonstrated with him daily, but without avail!

My uncle's kindly sympathy with animals showed itself when visiting us at Hamstead Marshall, in Berkshire. He expressed a wish to see the deer in the neighbouring park, and going in the evening we discovered them in a ferny glade lying cosily together. When we were about to clap our hands to make them canter off and show their beautiful horns he stopped us, saying it would not be kind to disturb them when they were so comfortably settled and had got their bed warmed for the night, so we left them to their slumbers!

Country walks with the dog were among his pleasures, which, however, the advent of motor-cars greatly marred. Lord Kelvin hated them; he disliked the feeling of excitement and rush they brought with them, and it pained him to see the cottage gardens covered with dust, and the mothers anxiously guarding their children. He thought, too, that the acquisition of them made people selfish, and he remonstrated strongly with his friends and relatives as one by one they began to acquire them. An entry in my diary tells the following anecdote: '*28th September* 1904.—Uncle William came down to breakfast looking much amused and very bright, saying that he had discovered a prophecy in the Bible promising that there should be no motor-cars in heaven, and he asked if any of us could tell where the passage was to be found. None of us could guess, so he referred us to Zechariah, 8th chap., 5th verse: "The streets of the city shall be full of boys and girls playing in the streets thereof." "No boys and girls," he said, "could play in the streets where motors were running about at the rate of 15 or 20 miles an hour," and he specially wished the William Crums to be told, and to be advised to consider this point.'

Carrier-pigeons were a great interest at Netherhall. The following letter from my mother tells about their acquisition :—

'NETHERHALL, LARGS, AYRSHIRE,
'*July* 19, 1887.

'MY DEAR DAUGHTERS,—Uncle William has got a pair of carrier-pigeons in which he takes great interest. They are quite young and are called Jack and Jill. They could not fly when he got them; now he is teaching them to carry messages. This morning he and Aunt Fanny went up to Glasgow, taking Jack with them. At Beith they tied a message to his leg and let him off. In three-quarters of an hour he alighted on the roof of the stable and then flew into his hole, and there was a great cooing between him and his wife. Uncle James went up a ladder and got the message, telling Uncle James and me to meet them at Castle Wemyss with the carriage at 5.30, which was a complete change of the arrangements made before they started. Yesterday afternoon we drove almost to Hunterston, and Jill was taken with us and let off there. She was home some time before us, though we watched her soar up and fly away quite in the wrong direction. This was the first time either of the birds was tried alone. The first time they were let off from Beith they took about eleven hours to come home, the second time I think two, and the third time about forty minutes. Uncle William has also let them off from Greenock; I forget how long the return took. They are beautiful creatures and so tame. . . .'

At Netherhall the Kelvin water-tap was evolved. My uncle was provoked at being unable to get taps that would not drip, so he set to work to invent one. I had the pleasure of watching its development, because, the house being full of guests, and I a young niece with a conveniently situated bedroom and a set-in basin, my room was selected for experiment—most interesting to me, though not always quite convenient.

Lord Kelvin threw himself as thoroughly into accomplishing this, his most insignificant invention, as into anything else he did. He was full of energy and fire, spending hours over it—considering, planning, testing, bringing mechanics into my room and instructing them clearly and concisely, pointing out the mistakes and getting things done over and over again till the desired result was achieved. To him, what was worth doing was worth doing well, and whatever he undertook was always of supreme importance till it was perfected and completed.

There is a funny story connected with this tap. In 1894, when we were in lodgings in London, Lord Kelvin called and, finding us out, left his card. When our landlord gave it to us on our return he remarked: 'Lord Kelvin is rather a clever man, he invented a water-tap.' Afterwards, when we related the story at a large dinner at my uncle's house, every one laughed except himself; he could not see the joke! I am afraid we laughed the more from seeing him so puzzled. He was quite satisfied to be thought 'rather clever,' and wondered at our amusement.

The following is an entertaining quotation from my diary at Netherhall in July 1888:—

'After breakfast Uncle William stood for a while with a delighted expression gazing at the reflexion of the window in the polished oak table in the turret window, nodding his head from side to side. "Come all of you quick and look! I see Haidinger's brushes better than I ever saw them before.' We all came and Aunt Fanny was able to discover them for the first time, but I do not think any of the rest of us saw them at all. Uncle W. told us how he had given a lecture on them one evening on board a ship going to America. The next morning it was very funny to see all the people nodding their heads from side to side, and gazing intently at the clouds.'[1]

I must not close this chapter without referring to Lord Kelvin's pleasure in the theatre; no boy in the Christmas holidays could have taken more simple and complete delight in it, especially if the play were amusing. A letter from my sister in 1885 says: 'We were at the theatre as I told you. It was Mrs. Langtry in *She Stoops to Conquer*. I was sitting next Uncle James and Aunt Lizzie [Mrs. James Thomson], and Uncle Wm. and Aunt F. were behind. It was delightful to hear Uncle Wm.'s hearty laugh, and to see Uncle James's thorough enjoyment in the play.'

Gilbert and Sullivan's plays were particularly enjoyed; and when my sister and I accompanied Lord and Lady Kelvin, *Patience*, *Iolanthe*, and *Ruddigore* all seemed specially entertaining with such an appreciative companion as my uncle, glancing smilingly round to see that we did not miss a single point. Curiously enough, however, he also enjoyed *Mock Turtle* or any other silly little by-play put on the stage to amuse early comers. He insisted on our hurrying our dinner and making no delay, that we might take our seats in the nearly empty theatre, and through the clatter of arrivals watch the play from beginning to end.

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[1] Haidinger's Brushes.—When white light is reflected from a polished surface it is partially 'polarised,' and behaves in a different way from 'normal' white light on passing through a crystal or other 'double-refracting' transparent substance. The difference is detected by Nicol's prism or other 'analyser.' The retina of the eye and its transparent humours act as 'double-refracting' and 'analysing' media. When the eye sees, for example, a white cloud by reflection, the 'polarised' light is broken into colours by the double refracting yellow spot of the retina, and the colours are seen as four faint alternately blue and yellow brushes round the point observed. Not every eye can see the colours at first, but once detected they are easily recognised again. Helmholtz in his *Physiological Optics* has discussed their nature and meaning.—Note by Sir Donald MacAlister.

Iolanthe was specially interesting, as Lord Kelvin had been consulted about the tiny electric lights the fairies wore in their hair (a great novelty then); and he had been at the rehearsals helping to plan and adjust them.

CHAPTER IX

WORK

Lord Kelvin was a tireless worker. The following letter, written by my mother from the University in 1891, gives a graphic picture of his intense activity: 'Uncle William arrived from London this morning, having spent two such busy days there that it takes one's breath away to listen to all he has been about. A large part of the first day was occupied with the Royal Society, which was the immediate cause of his going to London; but, after a quarter of an hour at the club for dinner, he hurried off to a meeting of the Society of Engineers, where he was kept till midnight. Next day he had hardly a moment for a meal. I cannot remember precisely what he was about, though Aunt F. has just given me all the details. He took a hurried breakfast here this morning, and started to the American Consul's to meet three deputies sent to consult him about electrical matters, and he has not yet returned, though it is almost two o'clock. Aunt F. has a bundle of letters, written by his secretary by his directions, given before he went out, awaiting his signature before being posted. She has them in order and can quickly tell him the contents of each. He is just coming in now, I hear, and some one is waiting to consult him on important business. There is nothing for it but that the consultation be held during lunch, for Uncle W. has to return to the consulate as soon as possible. Lunch is over and I listened and watched. The consulate official did not attempt to take any lunch, but asked questions and listened, and ran backwards and forwards to give orders to the secretary, who was hard at work writing. The young man was wonderfully quick and clever at taking in Uncle W.'s rapid utterances, the words rushing like a torrent. . . . Lunch over, the carriage was waiting to take Uncle William to the consulate, and the young man drove off with him to get a few more words; another also was invited to jump in too that he may also get a little advice, and away the three drove.'

Merely to touch on Lord Kelvin's theoretical work would be impossible for me. To the trained scientist much is exceedingly difficult to grasp, and to the ordinary individual it is quite unintelligible. He was, however, very practical, and said himself at the Institution of Civil Engineers in 1883 that 'the life and soul of Science is its practical application.' What also is most unusual in a scientist, he was a good business man; so that every discovery that could serve some useful end was at once developed and launched, resulting in great benefit to mankind.

Professor Alexander Russell, the President of the Institution of Electrical Engineers, said of Lord Kelvin at his centenary: ‘ His name would be world-famous if he had written on one only of the following subjects —Thermodynamics, Electricity, Magnetism, Elasticity, Telegraphy, Heat, Hydrodynamics, Electric Engineering, Mathematics, Dynamics, or Navigation. He wrote on and illuminated all of them. For many years he was the foremost physicist and the foremost electrical engineer in the world. . . . For the number, variety, and importance of his great contributions to science and to engineering he stands without a rival. His works are a gift to universal humanity. Had it not been for Lord Kelvin the world would have been perceptibly poorer to-day.’

Further, the President of the Glasgow University ’93 Club, at the time of Lord Kelvin’s death, said: ‘ Through his magnificent labours, Lord Kelvin proved himself not only a brilliant professor and a distinguished scientist, but a benefactor to the human race. For though he soared in high intellectual and scientific spheres, yet the results of his work have been so practical that all men have been made his debtors. Through him, life has become safer and happier on land and sea alike, continents have been united, and friendships knit closer together.’

Some of his most important and best known inventions are his mariner’s compass, his deep-sea sounding machine, and his tide gauge, hence the great appreciation in which he is held by seafaring men. A humble sailor once said of him: 'Every sailor ought to pray for him every night!'

A letter to my mother, dated 18th February 1877, says:—

'The compass causes quite unprecedented addition to my occupations, but it is very interesting, and as it takes me a good deal about shipping, it is not like plodding at writing or "book work." Willie Bottomley is most helpful, and has got on very well with some adjustments, which he has done all himself. He was down with me from Friday morning till Saturday evening in a new ship, *Baltimore Castle*, belonging to Messrs. Donald Currie & Co., which has been fitted with three of my compasses. We swung early next morning to adjust compasses. *I* should not have required this, but there were two other compasses on board, and it was thought right to have the ordinary certificate of the usual adjustment, both for mine and them.'

Both the compass and the sounding machine I had the pleasure of watching in process of construction when visiting on the *Lalla Rookh*.

While the compass was evolving we had to be careful where we sat, as castor-oil, in which the compass now rests, together with pasty paper and whalebone, were scattered everywhere. The whalebone had no concern with the final construction, but was useful in the earlier stages, and there is an amusing story connected with it. Lord Kelvin, accompanied by Lady Kelvin and a friend, were travelling together. My uncle never went anywhere without his 'green book.' In this he was making notes connected with the birth of the compass. At that time ladies' dresses were very tight-fitting, and supported all round with whalebone, which sometimes pierced the material and showed itself. Suddenly he turned to Lady Kelvin and said: 'Fanny, have you got a bit of whalebone about you,' and raising the edge of his waistcoat, he indicated where he expected it to come from. Lady Kelvin indignantly objected to robbing her dress in a railway carriage. The friend, however, from whom I heard the story, good-naturedly and with some difficulty supplied the desired whalebone: and during the rest of the journey my uncle occupied himself with it.

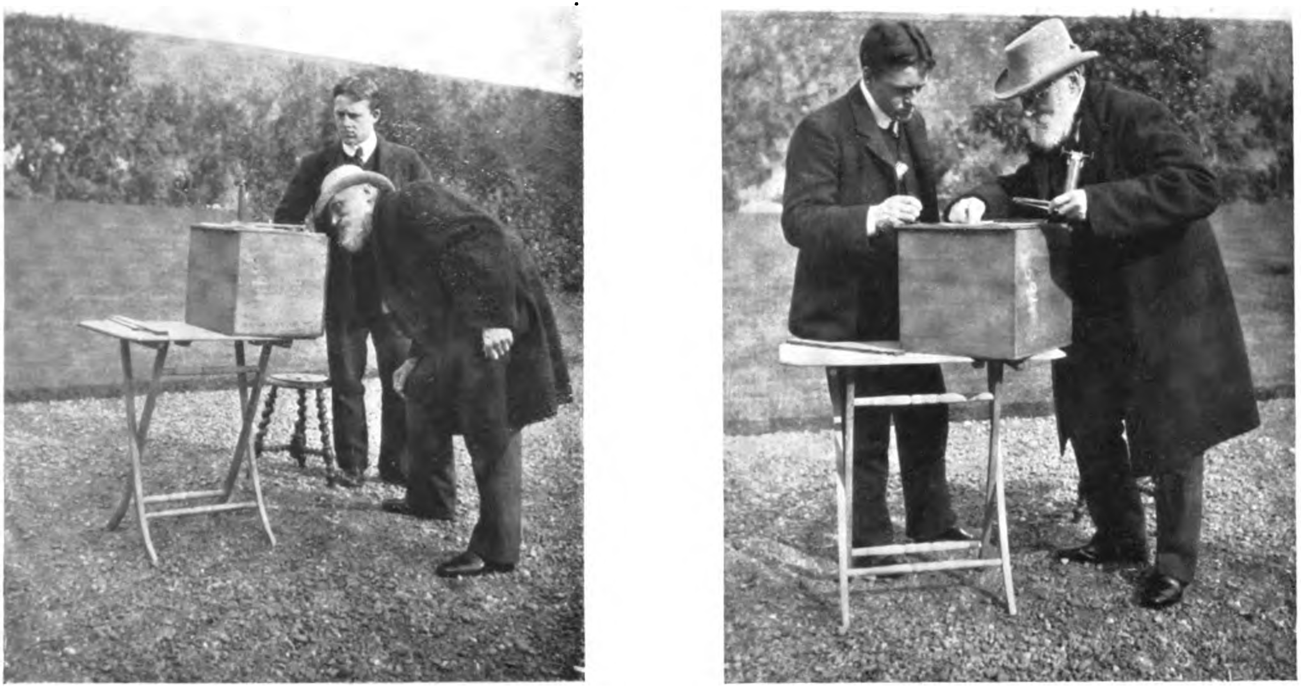
The old-fashioned compass that had served so long had many defects, which on vessels of steel or iron of the new type made it often quite useless. I was with my uncle in the *Lalla Rookh* when the first test was made of the new compass on a war vessel, the *Thunderer*, going at full speed and firing guns. Lord Fisher and a number of other important naval men were present. Lord Kelvin's face was radiant when they returned; his compass had acted with perfect precision, while the ship's own instrument whirled round and round and failed completely.

The main characteristics of Lord Kelvin's compass are: the extreme lightness of the compass card, the whole weighing only about two hundred grains, making the friction at the bearing-point exceedingly small. Instead of one heavy needle, there are eight thin strips of steel fastened with silk thread to the ring of the card, castor-oil is placed in the bowl in which the compass is fixed (this prevents rocking), and there is an arrangement by which, no matter how the ship may roll or pitch, the compass is kept horizontal. Besides there are wonderful devices to counteract the effects of the large amount of metal now used in the construction of all vessels.

Lord Kelvin's compass has now completely taken the place of the old instrument. It was, however, exceedingly difficult to get our navy to adopt it. I am sorry to say Germany was ahead of us, and installed it long before we did. The following letters from my mother show that it was in 1889 that the Admiralty finally decided to make Lord Kelvin's the standard compass:—

'UNIVERSITY, GLASGOW, *Nov.* 22, 1889.

'MY DEAR DAUGHTERS,—Uncle William went to London last night. He dined comfortably at 7.30 on all the courses, including entrées and game and his coffee, and set off in good quiet style, and the ladies went up to the drawing-room, when lo and behold! there was the "green book" lying on the



LORD KELVIN, WITH HIS ASSISTANT, IMPROVING THE AZIMUTH MIRROR OF HIS COMPASS IN THE NETHERHALL GARDEN

Photo by Elizabeth Thomson King, 1905

sofa. The telephone was instantly in requisition to summon a cab with all speed, and Margaret the housemaid was ordered to meet it [the train], and being a capable woman she did so, and succeeded in putting the precious book into Uncle William's hands before the train started, and he got it before he had missed it. . . .'

'UNIVERSITY, GLASGOW, *Nov.* 23, 1889.

'MY DEAR DAUGHTERS,—Uncle William came back this morning quite fresh after his busy day in London. It was to meet with the Lords of the Admiralty that he went. It is marvellous how easily travelling is conducted now. He goes so often by night to London, the railway attendant knows exactly how to make his bed and all the little arrangements he likes, and attends most carefully to his comfort. He drove at once to Admiral Fisher's, where he had his bath before 8.30 breakfast, and then set off about his various business. The meeting with the Admiralty was most satisfactory to him, for it is now ordained that his be the standard compass and be used throughout the Navy.

'Much mean and underhand work has been brought to light. For instance, 60 letters (I suppose in answer to enquiries) from Captains, one from the Captain of the *Euryalus*, spoke of some slight objection to the compass, eight said they had not had sufficient experience, and the remainder spoke of it in terms of unbounded admiration and appreciation.

Of these letters 51 had never been produced, but were hidden away in pigeon-holes in the Hydrographic Office, and the disapproving one was made a great deal of.

'I believe this has been going on for years, and that Admiral Fisher has been instrumental in exposing the abuse. . . . There is much of the circumlocution office in the whole affair. Uncle William does not want it talked of. . . .'

My uncle's attention was first called to the compass in 1871, and he was still working at it and improving it shortly before his death in 1907.

Lord Kelvin had to fight a very annoying case of infringement of his compass in 1888. The one compensation was that he stayed with us, and we enjoyed a longer visit from him than was often possible, especially as the case was a good deal delayed. I do not think I can do better than give the following extracts from my diary exactly as they were written at the time :—

'*Nov.* 20, 1888.—Case of Infringement of Compass came on at last, should have begun on Friday. Uncle William and Mother dined at Sir Antony Hoskins. Sir A. said to Mother: "I cannot tell you how all we naval men love your brother." Mother answered: "I think everybody who knows him likes him." "Likes him!" said Sir A. "*Like* is not the word, we all LOVE him."'

'*Nov.* 21.—We had great excitement at breakfast dressing up eggs boiled and raw in little net bags, and suspending them by threads to demonstrate the steadying effect of the oil under the compass-box. The arrangement was quite a success and Uncle W. went off in delight with his new toy, intending to call on Sir A. Hoskins on his way to court and show it. He also carried with him a letter from himself to the Attorney-General,[1] which ran as follows as nearly as I can remember: "I am requested by Sir Antony Hoskins to approach you on a very important matter. He wishes to offer you the position of Commander of the Fleet, as the compass will play a very important part in the next expedition, and he does not think there is any one who has such a thorough knowledge of it as yourself." Uncle William delivered his note while the Parnell Commission was sitting, and when he was reading the newspaper report of it aloud to us in the evening he skilfully inserted: "At this point a gentleman, who proved to be Sir William Thomson, entered the court and delivered a letter to the Attorney-General, which he began to read with great gravity and afterwards smiled." Uncle William came home in the evening looking very bright; everything had gone well, and the warm and hearty evidence which his friends among the naval men had given pleased him exceedingly. Captain Fisher's evidence was specially strong and very amusing from all accounts. He described the absolute steadiness of the compass in the bombardment of Alexandria when great guns were going off under it and beside it.'

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[1] Sir Richard Webster, afterwards Lord Alverstone.

'*Nov.* 22.—Dr. Gladstone and George and Isabel [King] and Willie [Bottomley] all dined with us. Just before dinner a budget of letters and papers came for Uncle William to study with regard to the Brush Light law case. Though deeply interested and much exercised in the matter, he managed to lay the whole subject quite aside during the evening, and throw himself into the interests of the little party.'

'*Nov.* 23.—Uncle William stayed up till one or two o'clock, thinking about the Brush case and seeing it in a hopeless light. And in the night over and over again he lit his candle to jot down ideas that came into his head. At five o'clock he woke quite up, a solution of the difficulty having darted into his mind. He could not rest till a long telegram was written out which Sarah (the maid) posted before breakfast. The tumbler of milk provided by Mother, which has hitherto been completely successful, quite failed this morning to give him more sleep when he lay down again. In the afternoon he sent us a telegram from the court to tell us that he had won his case, and he came and took Mother with him to make some calls. In the evening he was very tired and dosed while I played the piano, Lady Furry-purry (our Angora cat) as usual reposing on his knees and clinging on with difficulty owing to their oblique position. Her devotion has been very amusing and he seems quite to like it. When letters came from the little Crums telling about their kitten's home life and schooling, Uncle William had to hear them all, and listened with the greatest interest, suggesting that not enough was said about technical education—mousing, etc. When we said we hoped he would have occasion to be in London again soon, and that he would consider this house his hotel, he laughed and said he would call this the " Furry-purry Arms."

'Mrs. P. told us to-day that her children had come home quite proud on Saturday, saying they had seen " the big Sir William." Little Dolly added that she did not think him so very big after all; she expected he would have been a much bigger man to do such big things, " and," she continued, " he wears clothes just like anybody else's." '

A letter from Lord Kelvin to myself dated 27th November says :—

'MY DEAR AGNES,—Tell your Mother that I

look back with great pleasure to my time in Hamilton Terrace last week and the week before. It has brightened for me a very anxious and irksome duty in London, the latter part of which, however, became a pleasure, thanks to Capt. Fisher and the other naval men who gave much pleasing and amusing evidence, and to the happy conclusion of the case.'

The Sounding Machine has done much to make navigation safer and easier. Formerly it was necessary to stop to take a sounding. Lord Kelvin, however, discarded rope for the sounding-lead, and used piano wire, provided with a device which gave the depth by showing the pressure of the air in a tube. Thus soundings can be obtained when proceeding at full speed.

A friend finding him surrounded with piano wire asked what sound he was trying to produce. 'The deep C,' was the quick reply.

Lord Kelvin's tidal machines were very wonderful; by them he could tell the time of high water, and the depth of tide water at any moment at any given place.

Many years were spent studying tides and waves; waves indeed occupied his thoughts all his life, because they run their course through all science and nature; and at all times he was observing and learning, and finding something new about them, even in the most ordinary occurrences. Once when a large company of us were breakfasting at Netherhall and he was quietly stirring his cup, he suddenly looked up and exclaimed with delight: 'This is remarkable. I have never seen these waves before'; then, jumping up, he went round the whole table, cup in hand, showing to each of us the way in which by moving his spoon in a certain manner a certain result followed. Another time, when visiting us at a farm in Berkshire, he expressed a wish to see the dairy where Jersey creamers had been installed. The creamer is a double vessel; when the milk is put in, the outer vessel is filled with hot water, which causes the cream to rise quickly, and a tap at the bottom lets the milk out without disturbing the cream. When the milk was pouring out he became absorbed, and we got a mat that he might kneel and see without stooping; then he watched the water pouring out, and compared the manner of both. Afterwards, walking along the Kennet, the flow of water through the weir again attracted his attention, and he stopped and studied and took some notes in his 'green book.'

Watching the ripples caused by the ducks at Netherhall was also a source of great interest to him. In a letter to Lord Rayleigh he said: 'We saw a fine mode of generating a regular procession of ring-waves in water. We were watching a set of ducks yesterday on our arrival here, and the beautiful echelons of waves which they made when swimming. They seemed pleased at being noticed, and one after another stopped swimming and called out to us in their own language. . . . By looking at the ring-waves we could count the number of quacks we had heard.'

Lord Kelvin took great delight in the British Association and attended regularly. Sir J. J. Thomson says of him: 'His personality was as remarkable as his scientific achievements; his genius and enthusiasm dominated any scientific discussion at which he was present. He was, I think, at his best at the meetings of Section A (Mathematics and Physics) of the British Association. He would stay, generally accompanied by Lady Kelvin, from beginning to end of the meeting, bubbling over with interest and enthusiasm, having something to the point to say on nearly every paper. He made the meeting go with a swing from start to finish, stimulating and encouraging, as no one else did, the younger men who crowded to hear him. Never had science a more enthusiastic, stimulating, or indefatigable leader.'

Punch had him at the B.A. as a Jack-in-the-box, popping up and down. We were much amused with my mother, who was very offended with the caricature, which was certainly like but not what could be called flattering!

In August 1871 my uncle was President of the British Association in Edinburgh. It was considered an event of great importance, and his address was awaited with keen expectancy. He gave to its preparation long and anxious thought and careful deliberation. At first nothing would come to him, and he wrote on the 11th July: 'I cannot write a word of it, but it effectually prevents me from writing or doing anything else.'

Retiring to his yacht, he wrote :—

'I have really found the L. R. the quietest and best place attainable for work.' My eldest brother, George, joined him there and had a very happy visit. On the 18th July my uncle wrote : 'George began the day [Sunday] by reading a number of Chapters of 1st Corinthians, and spent a great part of the remainder in writing for me, towards the Address. I have taken some of the proceeds to the printers to-day, and hope to give some more instalments this week.'

My brother describes my uncle as pacing up and down the deck, dictating a few words at intervals, very slowly, and making many corrections.

On the 2nd of August an unusually brilliant assembly was gathered to hear the Presidential Address. On the platform with Huxley, the retiring President, were the Emperor Don Pedro of Brazil, and a crowd of distinguished savants, both British and foreign. But they had to wait! It had not occurred to my uncle to get himself a ticket, and when he arrived at the barrier, on his way to deliver his Presidential Address, the porter stopped him. He offered his card, but that had no effect. He said he was President and *must* get in. 'I have no orders about Presidents,' was the retort, and the cautious Scotsman remained in obdurate possession of the barrier. A crowd had gathered behind, my uncle was exasperated, and it was getting late, when at last Sir Norman Lockyer, I think it was, appeared and managed to put matters right.

The address which the over-cautious porter had delayed in no way disappointed expectations. It was full of originality and interest, and was listened to from beginning to end with rapt attention. His suggested hypothesis of the origin of life on the earth set the religious and scientific world on fire: 'How, then, did life originate on the earth? Tracing the physical history of the earth backwards on strict dynamical principles, we are brought to a red-hot melted globe on which no life could exist. Hence when the earth was first fit for life there was no living thing on it. There were rocks, solid and disintegrated, water, air all round, warmed and illuminated by a brilliant sun, ready to become a garden. Did grass and trees and flowers spring into existence, in all the fullness of ripe beauty, by a fiat of Creative Power? Or did vegetation, growing up from seed sown, spread and multiply over the whole earth? Science is bound by the everlasting law of honour to face fearlessly every problem which can fairly be presented to it. If a probable solution, consistent with the ordinary course of nature, can be found, we must not invoke an abnormal act of Creative Power. . . . When a volcanic island springs up from the sea, and after a few years is found clothed with vegetation, we do not hesitate to assume that seed has been wafted to it through the air, or floated to it on rafts. Is it not possible, and, if possible, is it not probable, that the beginning of vegetable life on the earth is to be similarly explained? Every year thousands, probably millions, of fragments of solid matter fall upon the earth. Whence come these fragments? What is the previous history of any one of them? . . . If at the present instant no life existed upon this earth, one such stone falling upon it might, by what we blindly call natural causes, lead to its becoming covered with vegetation. I am fully conscious of the many scientific objections which may be urged against this hypothesis, but I believe them all to be answerable. . . . The hypothesis that life has actually originated on this earth through moss-grown fragments from the ruins of another world may seem wild and visionary: all I maintain is that it is not unscientific, and cannot rightly be said to be impossible.'

The religious need have had no fear of Lord Kelvin, who ended his address with the peroration: 'Overpoweringly strong proof of intelligent and benevolent design lie all around us: and if ever perplexities, whether metaphysical or scientific, turn us away from them for a time, they come back upon us with irresistible force, showing to us, through nature, the influence of free will, and teaching us that all living beings depend on one ever-acting Creator and Ruler.'

The hypothesis also gave much food for merriment and doggerel verse. I remember one popular fragment :—

'From World to World
The seeds were whirled
Whence sprung the British Ass.'[1] [Association.]

In 1861 my uncle contributed a paper on the sun to the British Association. It had occupied him while laid up with his broken leg, and he was not able to be present and read it himself. In a letter to my mother he says :—

'One of my papers I think will interest David [my father]. It is to prove that the sun's heat is produced by the friction of his atmosphere occasioned by meteoric matter whirling round him, seen as perhaps you have seen it in the zodiacal light, and continually being drawn in by his gravitation and incorporated in his mass.'

To my father he wrote :—

'GLASGOW, *Jan.* 8, 1862.

'. . . I send, if possible by this post, a very rough draft of my paper on "The Possible Age of the Sun's Heat," which was read at the British Association by Prof. Rogers. . . .'

A further very interesting letter to my father is dated 3rd February 1862 :—

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[1] 'The British Ass.' was written by the clever versifier Alexander Nicolson.

'My dear David,—As to falling stars, you will remember (as I think I told you, and as the rough manuscript draft in your hand shows) I have formally abandoned the hypothesis that they continue at present falling into the sun abundantly enough to compensate him for the heat he radiates away from year to year, and I suppose him at present to be a liquid mass cooling. But it seems highly probable that the heat he is now radiating away was generated in ancient times by the falling in of meteors.

'I feel very strongly the difficulty you state as to shapeless detached stones being a primitive form of matter . . . it always seemed to me, much as it does now, a very improbable supposition. We know, however, that shapeless fragments of matter are actually met in millions by the earth in its course through space. In the theory accounting for solar heat by such masses having at one time fallen into the sun or having fallen together and built up the sun, hot and ready for his appointed task, we are not called upon to go a step further back and discover, or guess, an antecedent condition of those fragments or masses. Some suppose them to have arisen from the disruption of more dignified masses, but this is a mere hypothesis. What is *large* and what is *small* even to our ideas, enlarged and enlightened by science? We are equally far from comprehending an act of creation out of nothing, whether it be of matter in a finished and approximately round globe like the earth, or in small solid fragments or in a general diffused medium; although perhaps the last may seem the most probable to us in our present state of feeble enlightenment.

'But without attempting anything so much beyond our powers as the discovery of *the* primitive condition of matter, we successfully investigate the present condition, and argue from analogies and from strict dynamical reasoning what must have been the antecedent condition, with more or less of detail, back to more or less ancient times. Looking at the present conditions and functions of the sun, I argue back on this principle to the probable supposition that he has been built up by falling together of smaller masses. . . .

'With love to all, I remain, Yours affectionately,

'WILLIAM THOMSON.'

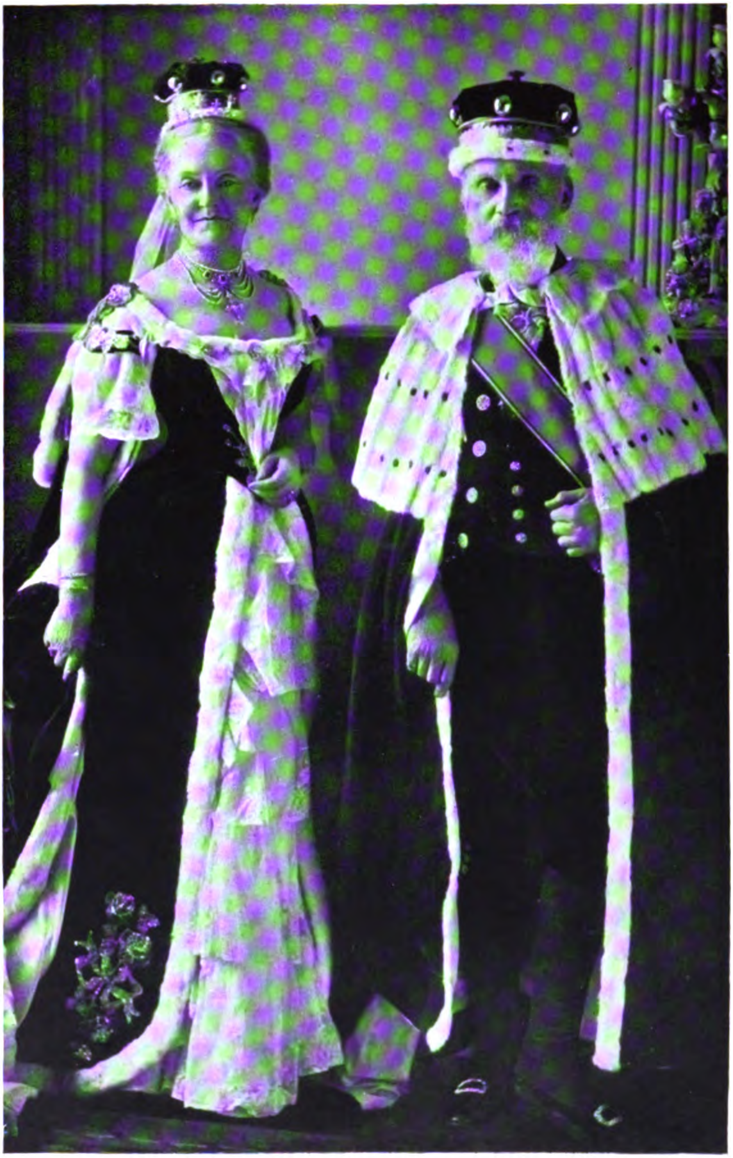
One of Lord Kelvin's lectures at the British Association was on 'The Physical Explanation of the Mackerel Sky.' He loved nature, but it was not as an artist. The sky was to him a lesson book, and the roar of the sea and the murmuring ripple of the Highland burn told him their secrets of motion and wave, while the mountains spoke of the age of the earth and past upheavals. I had a stiff argument with him once at the Royal Academy about art. I was very anxious he should admire a beautiful picture of Glen Sannox, with mist resting among the mountains; but he remarked that it was an unfortunate time to choose, and the artist ought to have waited till the mist had cleared away, and all the outlines of the mountains were distinctly seen. I tried to point out the artistic beauty of the picture, and also of another, a misty sunset, but he insisted that in so far as clouds or mists veiled the character of the landscape they were flaws. Some of his remarks, however, were very useful to me afterwards—he pointed out how beautiful geological lines were, and how utterly incorrectness in some of the pictures destroyed the effect. It made me realise the importance of a knowledge of geology to an artist, and that it is quite as necessary as anatomy. I read all the books I could lay hold of on the subject, modern ones and also my father's *Geology and Religion*, the first popular book on Geology ever written, which went through very many editions and comforted thousands of people, who had become fearful lest this 'heathenish Science' were upsetting the foundations of religion!

I found the geological knowledge I acquired of inestimable value in quickly catching the characteristics of the Canadian Rockies, and the mountains of Fiji and New Zealand and other places. It added also immensely to the enjoyment of the work.

Geology was a subject of intense interest to my uncle, but it led him into many a stiff fight with the geologists. The great trouble arose through old Mother Earth not having had the date of her birth registered, and the consequent difference of opinion as to her probable age. The geologists held that an infinite number of years was required to accomplish all she had done, while Lord Kelvin insisted that she must be comparatively young, only about 100,000,000 years old! The stiffest contests occurred with Huxley, and they were fought in deadly earnest. My uncle held his ground with unflinching tenacity, but always with an unvarying courtesy, which Huxley gracefully acknowledged in his retiring address when introducing Sir William as President of the British Association in 1871:—

'One matter, which lies within my own personal knowledge, I may be permitted to say of him as the old poet says of Lancelot, that

"Gentler Knight
There never broke a lance"'



LORD AND LADY KELVIN IN CORONATION DRESS

CHAPTER X

HONOURS

It was on New Year's Day 1892 that Sir William Thomson received the Peerage. Never was such a distinction received with sweeter and more child-like simplicity. He was very pleased, pleased that he had been thought worthy of it, and pleased at the kind way in which it was offered, and the enthusiastic congratulations of every one.

Both my mother and I were in Glasgow at the time. I was staying with the James Thomsons, and on New Year's Eve had been out at a party with my cousins. Professor James stayed up to receive us, and our knocking at eleven o'clock woke him from a doze by the fire. When he opened the door he remarked sleepily, 'My brother William has been made a peer.' We thought he was dreaming till he explained that half an hour before he had been disturbed by a messenger from the *Glasgow Herald*, inquiring what title Sir William was going to take. This was the first he had heard of the matter!

We gathered at the College next day, and there was great fun and excitement over what the name was to be. We were all full of brilliant ideas:

Lord Compass, Lord Cable, Lord Netherhall; Uncle William himself suggested that Lord Tom-Noddie would be rather nice! On the 3rd it was still undecided. My diary says: 'Uncle William listened with keen interest when Mother began discussing the various suggestions, and especially when it came to what she thought herself—"Lord Kelvin." "Did you think of that yourself? had you no hint? Fanny, do you hear that, Elizabeth agrees with us, that decides it. I will write to Lord Salisbury at once." Uncle William was exceedingly kind in his manner, and seemed greatly to enjoy Mother's congratulations. Over two hundred letters of congratulation have come and forty telegrams; the kind tone of all goes to his heart and fills him with happy wonder.'

The Kelvin is a beautiful little river which flows past the University, and in the gardens opens up into pretty lakes enlivened by the graceful swimming of swans and ducks.

A letter from my mother to my sister and me after I had returned to London says:—

'The University, Glasgow, *Jan.* 17, 1892.

'My dear Daughters,—Lord Sandford came in to afternoon tea. I introduced myself as an old friend, and he frankly shook my hand, saying: "It is many a long year since we saw each other." Then he stretched his other hand to Uncle William, and we stood all three in a little circle, and he exclaimed smiling: 'Here we are!' He spoke of the old college and the sports of the old, old days, and Uncle William and he recalled many instances of their early boyhood. After this talk Uncle William inquired about the ceremony of installing peers, and Lord Sandford described it rather comically, and has promised to coach Uncle William beforehand. He must be arrayed in his peer's robes and wear his peer's hat, and he must curtsey low three times, and take off and put on his hat three times, etc., etc., and take the oath of allegiance, and he must be supported into the House of Lords by two peers—Lord Sandford is to be one and Lord Rayleigh is to be asked to be the other. . . .'

The announcement of the peerage was received with great satisfaction by all sections of the Press. The *Spectator* spoke of him as 'the first man of science to receive the distinction of rank for work in that domain.' Another paper said: 'Not for services connected with the destruction of human life, but for those which elevate its character, enlarge its capacities, and increase its happiness, the new peer has deserved his honour.'

In a letter dated 19th January 1892, my mother gives a charming picture of Lord Kelvin at this time: 'Uncle Wm. and Aunt Fanny are just the perfection of kindness . . . we have such pleasant cosy evenings in the drawing-room that I feel grieved that we cannot sit up all night! . . . He looks most beautiful in the evenings just now, for he is wearing a most picturesque and becoming loose sort of coat or jacket not buttoned at all and showing the whole front of his faultless linen. It is soft fine black stuff, lined with rich red—it would look so easy and graceful in a picture.'

Very many distinctions and honours were showered on Lord Kelvin, one hundred and eighty in all, yet he never was *blasé*. They were all gratefully received with surprise and pleasure. He did not always find it easy, however, to express his thanks, especially if it had to be done in writing. A letter from my mother in November 1889 says: 'A new honour has just been conferred on Uncle William. He is made a Grand Officer of the Legion of Honour, the first foreigner on whom France has conferred the dignity, and it is reserved solely for the most distinguished men. He had some years ago received the distinction of Commander of the Legion of Honour. He was writing his letter of thanks to the President of the Republic, and it cost him as much trouble as some of my letters cost me. Aunt Fanny had to help him, and so had I. He had two more letters of a similar kind to write, but he got through them more easily.'

In 1884, the University of Heidelberg, at its tercentenary, wished to confer an honorary degree on Lord Kelvin; they found, however, that Doctor of Medicine was the only one he had not already got, so that diploma was duly presented. It caused great entertainment in the family circle. We all were seized with some occult malady, and besought his advice ; he at once tried our temperatures and felt our pulses, and wrote out prescriptions of a very amusing nature in Latin.

In the electric-belt case already referred to, the learned counsel who was to cross-examine him began by remarking that of course Lord Kelvin would have no medical qualification. 'On the contrary,' Lord Kelvin replied, 'I am Doctor of Medicine of the University of Heidelberg.' A ripple of laughter went round the court.

It was probably his proud position as a medical man that made him refer to the capping at the Leeds University as 'a painless operation performed on fifty-six persons by one surgeon, Lord Ripon!'

In July 1896, the Grand Cross of the Victorian Order was bestowed on Lord Kelvin. In Sir Fleetwood Edward's letter announcing it, he said that it was given by the Queen with a wish to appreciate the scientific services rendered by him during her reign. The Queen showed very kindly consideration when bestowing it, saying: 'Lord Kelvin must not kneel, it might hurt his leg.' This showed that she knew and remembered that in the previous winter he had been laid up for many months with a clot of blood in his leg. Her memory was very remarkable, as the following extract from my diary shows: '*14th July* 1896. Uncle William and Aunt Fanny have just been here telling us about their dinner with the Queen at Windsor Castle. The Queen was most gracious. Aunt Fanny says she is very stout, and very lame, and is getting blind, but she arranges everything, even to where all the guests are to sit at table. After dinner they all sat in the corridor, and one after another of the guests was brought up to speak to the Queen at her request. When Aunt Fanny came, she said to her: 'It is a long time since we have met, not since we were at Inveraray Castle, that is twenty years ago.' Then she asked how Uncle William was, showing that she remembered his illness.

The meeting at Inveraray Castle had a good deal that was entertaining about it. The Duke of Argyll, who was a great friend of my uncle's, asked him, when he and Lady Kelvin were yachting in the neighbourhood of the Castle, to let him know and to come and spend a few days there. When Lord Kelvin wrote, the Duke replied, begging them to come by all means, but adding that, as Queen Victoria and her suite were staying in the house, they would have to sleep in the *Lalla Rookh*. The first time they met the Queen was when they were walking in the garden. They saw a most remarkable figure approaching them, in a mushroom hat and goloshes and with skirts bundled up under an old and voluminous waterproof cloak; to their astonishment they found it was Her Majesty. When, however, they came face to face and she spoke to them, she was every inch a queen. At dinner she was talking about her own yacht and discussing yachting, and she made some nautical mistakes. Lord Kelvin was on the point of putting her right, when Lady Kelvin touched his foot under the table. The Queen was very strict about etiquette, and, in the circumstances, Lady Kelvin found it no easy matter to comply with the regulation never in the evening to wear the same dress twice. She carried few things in the yacht, and her maid had to turn them about and alter them ingeniously to give them a varied appearance. One evening the Princess Louise, in handing something to the Queen, upset a flower-glass. Lord Kelvin came immediately to the rescue, and, pulling out his handkerchief, sopped up the water and squeezed it into his tea-cup. Her Majesty was intensely amused and burst into a hearty fit of laughter, and the incident entertained her so much that she continued smiling till she retired for the night.

King Edward VII., when he was Prince of Wales, saw a good deal of Lord Kelvin, and was very friendly with him. Lord Kelvin considered the Prince a man of remarkable intelligence, and said that it was wonderful the way in which he grasped a new idea, and the interest he took in Science.

For the Princess Louise Lord Kelvin had a real affection; and it was returned, for in a letter to my sister after his death, she spoke of him as 'dear Lord Kelvin.' On the 29th of November 1904, when he was installed as Chancellor of Glasgow University, his first duty was to confer an honorary degree on the Princess. Lord Kelvin was not at all well at the time, and an acute attack of facial neuralgia came on before the function. The Princess, who was in the house at the time, was greatly distressed to see his suffering and was full of sympathy. She procured an egg and some wine, and with her own hands made egg-flip, and brought it to him in a glass so kindly that he was very touched and could not refuse to take it. It really did him good, and helped him to get through the ceremony and to deliver his address. It was a touching address, eloquent in its simplicity. He spoke of himself as 'a child of the University,' and recalled many beautiful memories of his sixty-seven years' connexion with it, and ended by saying: 'It will be a great happiness to me for the rest of my life to be Chancellor of my beloved University of Glasgow.'

In recording the event, the *St. James's Gazette* said of him: 'Wealthy and famous and of prodigious learning, he is still one of the most modest and simple-minded of men, with an exquisitely gentle face framed in snow-white hair, and a smile which is like a benediction.'

MARGARET GLADSTONE (MRS. RAMSAY MACDONALD)
AT THE AGE OF SIXTEEN

Photo by Agnes Gardner King

CHAPTER XI

THE JUBILEE

THE Jubilee of Lord Kelvin's Professorship was a great occasion. It took place in June 1896. The official record of the event, published by the University, says: 'It was because of the unique character of the work done, and the personality of the worker, that the Jubilee of Lord Kelvin became one of the most strangely impressive functions. It had in it something of the nature of a spontaneous outburst of enthusiasm as well as of the studied and respectful homage shown by representatives of all the world to a great thinker and actor.'

It was a marvellous gathering—famous men from all over the world were there; and representatives from societies and universities in every country came bringing beautiful addresses, wonderful not only in the admiration but in the genuine affection expressed.

Lord Kelvin was overwhelmed by it all and deeply moved; and his speeches, both at the impressive function which took place in the Bute Hall on the 16th and at the banquet in St. Andrew's Hall in the evening, were full of feeling, and went to the heart of all who heard. He spoke gratefully and lovingly of all the kindness he had received and was then receiving so abundantly, and of 'having enjoyed for fifty years the privilege of spending my time on the work most congenial to me in the happiest of surroundings.'

The Lord Provost, in proposing the toast of the evening at the banquet, said: 'Lord Kelvin's discoveries and appliances have world-wide use, from the most complicated and delicate instruments to improvements on the simplest form of mechanism. His industry is unwearied, and he seems to take rest by turning from one difficulty to another—difficulties that would appal most men, and be taken as enjoyment by no one else. But what has been the result of these great gifts of genius, coupled with this industry? They have resulted in a lifetime of discoveries fraught with good; year by year something has been accomplished; papers that are standards on their subject-matter have been written till we are lost in amazement at what has been done; while, concurrently with this productivity, his lordship's University classes have been carefully carried on. How many students in these fifty years of jubilee have been fired with their teacher's enthusiasm we shall never know, but from this class many have gone who have attained great distinction. . . .'

Lord Kelvin's reply was full of affectionate gratitude and humility: 'When I think how infinitely little I have done I cannot feel pride; I only see the great kindness of my scientific comrades and of all my friends in crediting me with so much. One word characterises the most strenuous of the efforts for the advancement of Science that I have made perseveringly during fifty-five years; that word is *failure* . . . but in the pursuit of Science, inborn necessity to make the effort brings with it much of the *certaminis gaudia*, and saves the naturalist from being wholly miserable, perhaps even allows him to be fairly happy in his daily work. . . .'

Letters from my niece, Margaret Ethel Gladstone, afterwards Mrs. Ramsay MacDonald, give a vivid account of the proceedings. '. . . The functions in the morning and evening were most interesting, and I thought his speeches beautiful. I like all the fuss that is made much better than I expected, for none of it seems mere empty compliment; it is all so hearty and given with such good will. . . . The Graduation Ceremony began by the presentation of over eighty addresses from all parts of the world. . . . The gowns and uniforms of the delegates were most varied and gorgeous. . . . The Lille professors had orange gowns; but the most gorgeous of all was the Italian Ambassador, with rows of orders across his uniform. . . . After the capping, Uncle William made his reply. Some of us were quite afraid he was going to break down, he got so pale and the effort to find words seemed too much for him. I thought his speech was beautiful; so did every one. . . . In the evening the word "Failure," in which he characterised the result of his best efforts, seemed to ring through the hall with half-sad, half-yearning emphasis . . . yet at the same time it was not pessimistic, for it was so evident what keen joy he had had in his work. . . . In thinking over Uncle William's speeches, the tone in which he gave them, and his quiet, serious, deferential look when praise was heaped on him, dwell in my memory. There was something pathetic about it all—a sort of wonder that people should be so kind to him, and a wish that he had done more to deserve it all.'

In a letter to my mother my sister says: 'I can't write much of a letter to-day, just because we have been doing and seeing and thinking and feeling so much which I long to tell you about! . . . How I wish you could have been here! But it would have been too much for you I am sure. Uncle William looked quite lovely last night, receiving all the thousands that came to shake hands with him. He had a gentle, kind smile for each, and looked so simple and childlike in all his glory. Just to watch him was for me and for many the chief pleasure of the evening. Aunt Fanny too was very sweet and gracious, and they looked so nice standing together on a raised platform of some kind. The function to-day was still more interesting—the capping. You will read all about it in the papers, but they can hardly give you the emotion of the whole thing.

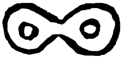
Uncle Wm. again was just beautiful. He received all the tributes offered to his genius, and the compliments to his character, so humbly and sweetly, and at the end made such a touching answer to them all. He seemed nearly to break down for a moment, but got through, and everybody said he never spoke better. Some of us found it difficult not to be overcome, and I felt sure you would have felt it too much.'

A further letter from Margaret Ethel Gladstone at this time says: 'Many of the scientific men went off that night or next day, but a good number were left to go on a steamboat excursion on the *Glen Sannox*. It pelted all morning . . . we could just see Netherhall looming through the mist as we passed it . . . in the middle of the afternoon some of them got up the Lancers on deck, and it was great fun to see Aunt Fanny leading off with Professor Ferguson. . . . Uncle William is simply marvellous: he is seventy-three, and has been ill all winter and spring . . . and yet after all he has gone through of physical and mental and emotional exertion, in the last few days, and an address from and a speech to the Liberal Unionist Association this morning, he was quietly on the alert, taking in all the addresses and all that was going on in the bustle; and then, when we came in to tea, talking away with my father about chemical theories, and about the terrible shipwreck there has been, and everything that turned up.

'The next day we came up with them in the same train. At the last minute, his "green book" was left behind, so he had to content himself with answering his telegrams (they had written twenty telegrams before we lunched with them at Preston) and writing letters to Quincke, Stokes, and James Bottomley on Röntgen rays, etc. Then at 9 P.M. he was taking the chair at the Royal Institution, and, as Aunt Fanny said, seemed better than before he went down to Glasgow. He appreciated the beauty of the country too on the way up, and thought I was using my time well by looking out of the window a good deal—it certainly was a perfect day, with blue sky and sunshine, and clouds to give shadows, and the hedges lovely with wild roses.'

Margaret Ethel Gladstone was the daughter of Dr. J. H. Gladstone, F.R.S., and of my eldest sister Margaret, who died at her birth; she was consequently grand-niece to Lord Kelvin, and she was a great favourite both with him and with Professor James Thomson. She was very bright and highly intelligent, and, while still quite young, quickly got a grip even of difficult subjects; so her uncles really enjoyed talking to her, and it delighted her to help them with their experiments. The following extracts from letters of hers, written when on a visit to Netherhall in 1892, are amusing: 'In one of Uncle William's papers on "The Stability of Periodic Motion," it was very lovely to see him try to balance the long pointer on the tip of his fingers. Helmholtz and Uncle William were inseparable. . . . I had a very nice time ; as I was so long at Netherhall, I got to know them much better, and to be devoted to them . . . generally the house was full of company; 24 different people stayed in it while I was there, and endless people came to dinner and tea and lunch. Aunt Fanny likes company very much, and as for Uncle William it doesn't seem to make much difference to him what happens ; he works away at mathematics just the same, and in the intervals holds animated conversations with whomever is near.

'They were both very good to me ; and the time I liked best of all was one day when there were no visitors at all, and we were quite by ourselves for thirty hours.

'Uncle William was busy with some great mathematical question ; and a side-issue connected therewith was the making of Mercator charts of objects of various shapes.[1] An anchor-ring can be made into a single oblong sheet by being cut round the circumference and also at right angles. But to mercatorise, or skin, a double anchor-ring, or treble, or multiple, was more complicated, and for several days we all were employed on that problem. It was very amusing. Uncle William was always breaking out in the middle of meals, or driving, etc.: "Margaret, I 've thought of a better way to skin the double anchor-ring," and then describing it. We had no double anchor-ring, so I suggested getting one made in dough; and I believe they had great fun getting the cook to make a loaf like this, ; but I was out on a steamboat excursion at the time. When I got home I found Uncle William wanted to cover this all in one piece somehow, so I got my paint-box and we painted the loaf prussian blue, leaving white lines where it must be cut. That blue loaf was Uncle William's constant companion for days: and Aunt Fanny said a fortnight ago that it was still knocking about

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[1] The 'Mercatorizing' of the Anchor Ring relates to a geometrical problem that Lord Kelvin took up with characteristically keen interest in 1892. He wrote about it in *Nature* of that year. There is a paper in *Nature* for September 22 on a 'Generalization of Mercator's Projections performed by aid of Electrical Instruments,' and another on October 6, 'To draw a Mercator Chart on one sheet representing the whole of any complexly continuous closed surface.' He applied electrical ideas to the solution of this (purely geometrical) problem. At the conclusion of the second paper he remarks, 'The solution of the geometrical problem was a necessity for the dynamical problem with which I have been occupied, and this is my excuse for

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working it out, though it might be considered devoid of interest in itself.'

The problem in effect is to skin the surface and then to stretch the skin so that it will be perfectly flat, following certain definite rules as to the proportions in which the parts are stretched. The rules to be followed are the same as those that apply when a portion of the (nearly spherical) surface of the globe is represented on the flat by means of 'Mercator's projection,' which is the device usually employed in drawing charts for the use of navigators. In such charts there is no stretching at the equator, but there is more and more stretching as you pass from the equator towards either pole; and at any place there is the same amount of stretching in the north-south direction as there is in the east-west direction.—Note by Sir Alfred Ewing.

Your affte brother

Kelvin (William)

LORD KELVIN WITH HIS 'GREEN BOOK,' DISCUSSING A PROBLEM WITH HIS SISTER ELIZABETH (MRS. KING)

Photo by Agnes Gardner King

the drawing-room at Netherhall. Some of my suggestions were squashed at once because they didn't fit the mathematics of the subject; the mathematics went on vigorously in the "green book." That "green book" is a great institution; there are a series of "green books"—really notebooks made specially for Uncle William, which he uses up at the rate of five or six a year, and which are his inseparable companions. They generally go upstairs, downstairs, out of doors and indoors, wherever he goes, and he writes in his "green book" under any circumstances. Looking through them is quite amusing; one entry will be in the train, another in the garden, a third in bed before he gets up; and so they go on at all hours of the day or night. He always puts the place and exact minute of beginning an entry.

'It gives one rather a common-sense way, or scientific way, of looking at things to stay with Uncle William: you begin to feel that everything has a reason, and that that reason may be found out; and things should not be slurred over or left to chance when you can direct them by taking a little trouble and using a little thought.'

Margaret's marriage to Ramsay MacDonald was a very great surprise to us all, and a bit of a shock, but it in no way broke the warm friendship, and the new-comer was soon admitted to our family circle. On Sunday at Hamilton Terrace we had very interesting gatherings, and the conversation flowed freely and happily. Lord Kelvin remarked on several occasions what a nice young man Ramsay was, and what a pleasant talk they had had.

It was a great sorrow to my mother that she could not be present at the Jubilee, but her health was failing, and it was out of the question, so I remained with her; and very soon after, on the 28th of June, she was taken suddenly ill and died on the 23rd of July. Uncle William's anxiety and grief were most pathetic. He came every day to inquire, and seemed quite broken-hearted when we could not report improvement; and when he had been taken in to say good-bye he broke down altogether. 'My dear, dear sister, I shall miss her more than any one.' My mother had a very warm place in the hearts of both her brothers (Uncle James had died some time before). She had been a dear little elder sister to all the younger ones, and, being motherless, young as she herself was, she guided and helped them, and the boys gave her their confidence and brought her their little troubles; the early letters reveal an unusual intimacy. She joined in all their fun too; but, the strain having been too great, when she was about fifteen she broke down, and for a long time was very delicate; so the boys took her about with them in a wheelbarrow, and at their picnics made a soft bed of grass for her, and laid her on it, that she might without fatigue be among them.

My uncle's great love for my mother seemed to give my sister and myself a specially warm place in his affections, which became intensified after her death.

When we had settled in Wroxham he came in 1906 with Lady Kelvin to see us in our new home. We took him in our boat on the river, and he steered. He said it brought back old Cambridge days, and was delighted that we had called our boat the *Nautilus* after his. He was interested in everything and enjoyed everything ; and as he was stepping into the carriage to leave, he turned and sweetly and reverently blessed our home and blessed us. When he died in December the following year we sent a few winter flowers we had gathered in the garden, and we were deeply touched to learn that Lady Kelvin had directed that our humble little tribute should, with her own cross and the Royal Society laurel wreath, be placed on the coffin. Our hearts were very full when we looked down into the grave in Westminster Abbey and saw it there ; but in its very simplicity it seemed specially to belong to him.

CHAPTER XII

CLOSING YEARS

A VERY interesting event occurred in November 1906, which is described in a letter from Lady Kelvin to my sister: 'On Saturday we went up into North London for rather an interesting thing—The National Telephone Co. bought a building up there for one of their stations, and then discovered it had been the place of worship of the sect "Sandemanians," of which sect Faraday was a member; this led them to make inquiries, and they found it was the very building in which he worshipped, so they wrote at once to Uncle Wm. that they would like to put a tablet on the wall recording this fact, if he would come and unveil it; and they are very proud because they have put the tablet, and added that it is unveiled by Lord Kelvin, so they have the two names on the tablet. I think your uncle was the only person present who had even seen Faraday except some of Faraday's own family, and he made his speech on his own personal recollections.'

Lord Kelvin spoke of him as 'the inspiring influence of my early love for electricity. . . . His encouragement was most valuable. I treasure it now, and I can look back upon it as an inspiring influence throughout my life. . . .' The speech was delivered with great emotion and feeling.

At the British Association in 1867, after Faraday's death, Lord Kelvin's tribute to him, in opening the Mathematics and Physics section, is very striking, and exhibits an extraordinary likeness between the two men :—

'I wish I could put in words something of the image which the name of Faraday always suggests to my mind. Kindliness and unselfishness of disposition; clearness and singleness of purpose; brevity, simplicity, and directness; sympathy, with his audience or his friend; perfect natural tact and good taste; thorough cultivation—all these he had, each in a rare degree; and their influence pervaded his language and manner whether in conversation or in lecture. . . . Something of the light of his genius irradiated his presence with a certain bright intelligence, and gave a singular charm to his manner which was felt by every one, surely, from the deepest philosopher to the simplest child.'

The dominant characteristic of Lord Kelvin was his extreme lovableness, which seemed to grow and broaden with advancing years. He had a certain fieriness of character which was quickly roused to indignation by any meanness, or even by inaccuracy or foolish conceit, and which then burst forth in no measured tones. This became merged as time went on in the greatness of his gentler nature, which grew too full of love for God and man to leave much room for other feelings. One could not look at him without reading in his whole expression 'he that dwelleth in love dwelleth in God and God in him.'

This lovableness impressed itself on every one, and even when honours were publicly conferred a note of affection ran through the presentation. When in 1903 the University of London for *once* broke its rule never to confer honorary degrees, and made him Doctor of Science, Sir William Tilden ended his address with the words: 'Regarded with affectionate reverence by his contemporaries, it cannot be doubted that his name will shine brightly through long future generations. In offering the place of honour to such a man the University confers lustre on itself.'

Thackeray once said of Lord Kelvin that he was an angel, and that he was certain there were wings under his flannel waistcoat. The 'flannel waistcoat' is the saving clause; Lord Kelvin was too human to suggest an angel. To the end of his life there was something boyish about him which took away all fear of the great man, and caused every one to feel at home with him. He never made others feel stupid, but always drew out the best in every one.

It seemed sad that he should have been called upon to suffer a great deal, especially from 'tic douloureux,' which increased towards the end of his life, and sometimes lasted for days; but if we had never seen him patient in suffering we should not have known the full beauty of his character. When an attack of pain came on the agony in his face was all too apparent, in spite of his efforts to hide it. As soon as it passed, however, he always remarked cheerfully, 'I think now that will be the last turn and I shall not be troubled again.'

A letter from Lady Kelvin in January 1905 to Mrs. Ramsay MacDonald says: 'I am sorry to say he has been suffering terribly badly from the pain in his face. It has been quite the longest and worst attack that he has ever had, I think; and there is hardly any diminution yet. He has hardly been out since his installation on the 29th Nov. We went up to see a doctor in Glasgow last week, but doctors do not seem to be able to do anything for this particular ailment, and acknowledge themselves helpless. He was better for a day or two, but to-day he is very bad, owing partly, I think, to a roaring east wind, which is very cold and searching.'

Once when a protracted illness caught him and laid him up for a considerable time, Lady Kelvin wrote: 'He has been three weeks in his bed. Can you imagine his bearing it patiently? But he does, and keeps everybody busy about him, and for himself the day is never long enough.'

In 1895-6, Lord Kelvin went through a very long ordeal, when for nearly six months he was tied down by a clot of blood in his bad leg, and, in addition to that, an acute attack of pleurisy. To a man of his intense activity it was a great trial, and he suffered much pain both in his leg and in his chest. But the strength of character which had made him all his life courageously face and overcome difficulties now enabled him to bear his disability with unmurmuring patience, and, except when the fever held him, to throw his energies into accomplishing a great deal of most important work.

The following quotations from letters give a vivid picture of this time :—

Lady Kelvin to my mother, *30th January* 1896.

'Your letter yesterday morning was a great pleasure to William. I am sorry to say he is not very well, his leg is tiresome enough, but since Monday he has been quite ill with a sharp attack of pleurisy . . . there has been a good deal of pain, but it is getting less. . . . He is the most patient, obedient patient.'

On the 26th of January he himself wrote to my mother in acknowledgment of a little picture painted for him by her. She was seventy-seven at the time, and although the little painting was executed like a miniature from a pencil sketch of her own, she worked without glasses.

'THE UNIVERSITY, *Sunday*, *Jan.* 26, 1896.

'MY DEAR ELIZABETH,—I am very sorry to have been so long prevented from writing to thank you for the lovely New Year's gift (I can't look at it and see it as only a New Year's card). . . . I have had my secretary at work with me from instantly after breakfast (sometimes even before it was finished) till 7.45 or 8 in the evening, every day except yesterday, when I managed to get him away by 2.30 for a Saturday afternoon walk which he told me he was to have with a friend (this sort of thing will become illegal, I am afraid, when the 8 hours Bill becomes law). So you will understand why it is that I have been so long kept from writing to you.

'Fanny and I both think the picture quite lovely, with the old tower overgrown with hanging creepers, and the ruined village, and the dome of St. Peter's in the distance. We are going to have it framed and hung up where we can see it.

'I am still ordered to keep my bad leg up and give it all the rest possible, and told emphatically that the more thoroughly I obey this order the sooner I shall be quite well and able for everything. I am feeling perfectly well and am getting on with my work (with secretary's aid) as well as staying in bed till lunch-time, and as nearly as possible in the same position [as] night downstairs allows, but it is tiresome and disappointing to be so long kept from walking about, and going to the laboratory for my work there, which is always going on, etc. etc.'

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In letters to my mother from Lady Kelvin, 10th and 26th February, we find him not so well and quite confined to bed, but cheerful as usual :—

Feb. 10, 1896.

'The leg is going to tie him down for some time, I fear. The doctors all insist on the necessity for absolute rest. . . . The remains of pleurisy is keeping him still in bed. . . . William frets very much at not being able to take his lectures. He has had the Higher Mathematicians twice in the dining-room. William is able now to get into bed in the spare room in the daytime, which he likes much better, and his secretary has his writing-table there. He is allowed to do some work, fortunately.'

Feb. 26, 1895.

'. . . William is really very well in his bed and *very* busy. The days are never long enough for all he wishes to do. He was very disappointed last Saturday, but now has made up his mind to the inevitable.'

A letter from my sister on the 29th of March finds him still laid up but getting better :—

'THE UNIVERSITY, GLASGOW, *March* 29, 1896.

'MY DEAREST MOTHER,—You would get my telegram rather late last night telling of my safe arrival. I was shewn straight into Uncle William's study (upstairs), and found him in his big chair, with his leg supported on a rest, looking very cosy and very well indeed. This morning in bed he looks still better (it is now after breakfast, and I have been up to see him). He is attired in a bright red jacket which would delight your heart, and the effect is heightened by a blue and white striped knitted quilt which is laid round his shoulders. The bed is strewn with papers of all kinds, and he looks as busy and happy as possible. Aunt Fanny says he has been making very decided progress the last ten days or so, and she thinks this evening he is going to come into the dining-room for the first time.—Your affectionate daughter,

'ELIZABETH T. KING.'

Lord Kelvin had been through the greater part of his life unusually strong and healthy, and able for an amount of exertion both mental and physical quite beyond the powers of any ordinary man. A cold he hardly ever took; this, however, he attributed to his own plan, which he recommended most vigorously to every one: when he felt chilly he put on an extra waistcoat, and if the chilliness continued, another was added, and another till sometimes there were as many as eight. Thick heavy clothing he never wore; several ply he considered much more effective.

Lord Fisher in his *Memories* says of him :—

'Of all the famous men I have known, Lord Kelvin had the greatest brain. He went to sea with me in many new ships that I commanded. Once, in a bleak March east wind at Sheerness, I found him on deck on a high pedestal exposed to the piercing blast, watching his wonderful compass, and he had only a very thin coat on. I said: "For goodness sake, Sir William, come down and put on a greatcoat." He said: "No, thank you; I am quite warm. I 've got several vests on." His theory was that it is much warmer wearing many thin vests than one thick one, as the interstices of one were filled up by the next one, and so on. I explained this afterwards as I sat one day at lunch next to the Emperor of Russia, when he asked me to explain my youth and good health, and I hoped he would follow Lord Kelvin's example, as I did. Lord Kelvin got this idea of thin vests instead of one thick one from the Chinese, who, in many ways, are our superiors.'

My uncle never seemed to require rest from his early breakfast till he lay down in bed late at night, and was immediately wrapped in childlike sleep. This made his patience and resignation all the more wonderful when sickness with its companion weakness came to him.

It was not until the 1st of October 1899 that Lord Kelvin retired from the professorship, and even then he did not break his connexion with the University, for he insisted on inscribing his name on the University roll as a 'research student'! and a research student he certainly was to the very end of his life, thinking, and studying, and working.

He accepted his peerage very seriously, and tried earnestly to fulfil its obligations. To take his place in the House of Lords he considered an absolute duty, though it used much of his precious time and strength; and many most important and beneficent measures were thoroughly examined and carried through his determination. Shortly before his death he was agitating for the better protection of the seamen, whom he always held so near his heart; and the use of dangerous oil moved him greatly. He protested very strongly against the sale of cheap paraffin of an explosive character: 'I call it terrible that 25 per cent. of all the deaths by fire in London during the year were due to paraffin-lamp accidents. . . . I think the accidents which have been reported are amply sufficient to justify prohibitive legislation—amply sufficient. . . .'

A caricature of him appeared in *Vanity Fair*, with an appreciation: 'He is so good a man that four years ago he was most deservedly ennobled as Baron Kelvin of Largs; yet he is still full of wisdom, for his Peerage has not spoiled him! . . .'

To the end of his life Lord Kelvin's mind was busy with what he himself called 'a superlatively grand question—what is the inner mechanism of the atom?' The tiny little atom reaching the infinite in its marvellous smallness was ever present in my uncle's thoughts, from the time when he was able to think at all scientifically; and we find it cropping up all through his life in letters and papers. In 1870, when the weekly journal *Nature* was founded, he contributed an article on the size of the atom —'a two-hundred-millionth of a centimetre' he gave as its size.

At the British Association in 1901 he spoke entertainingly in defence of this beloved atom, which had been attacked in 'a most rude recrudescence of neo-pantheism, neo-Berkleyanism, neo-vitalism, and neo-nihilism.' 'It was,' he said, 'practically a reality, and it would be mere word-splitting to say that we were agnostics in respect of it. Agnostic meant not knowing. Now we were all agnostic in most things in nature and religion, because we did not know them; but to be satisfied with agnosticism, or to delight in it, was absolutely unscientific. There were mysteries far beyond the range of science, but when . . . Prof. Haeckel, following Vogt, recently asserted that matter and ether were not dead, but were endowed with sense, that was neo-vitalism with a vengeance. Matter and ether, we were asked to believe, experienced a wish for condensation, and they struggled against strains! We were to picture, in fact, a lively struggle between the clay and the potter, the one with as much life as the other, but struggling together to make a pot!'

In March 1907, the year of his death, he was still defending his atom, and telling the chemists in a lively way at a dinner of the Chemical Society that they had better not call 'atom' a thing that could be broken.

On the 2nd of August, at the British Association in Leicester, there was a most intensely interesting and instructive discussion on the Constitution of the Atom, and Professor Silvanus Thompson, who was present, speaks of Lord Kelvin taking 'up the argument with all the keenness of a young debater.' 'He could not believe that the mere motion of electrons gave the widely different properties and degrees of stability which are recognised as belonging to the different kinds of matter called elements. Nor could he believe that radioactivity was a mere residue of the kinetic energy of the atom. He preferred rather to regard the atom as a gun loaded with shell which again contained a charge; for when the atom threw off an electron it did not cause the bursting of the atom any more than the firing of the gun effected its destruction. His gun—the atom—had probably been loaded before there were sun, stars, or any of the things we now know, and it only required contact with matter to release the trigger and fire off the shell.'

Thus when eighty-three years had gone over his head, he was still endeavouring to unfold the marvels of God's creation, and seeking for knowledge in the vastness of space, and in realms strange and wonderful in their infinite, immeasurable minuteness.

Though his mind was as clear and bright as ever, his body was failing, and the shadows of earth were gathering about him. But he kept resolutely at work, still improving his compass, begun thirty-six years before; still being carried, to use his own words, ‘ not on aeroplanes,’ but ‘ on the strong sure wings of scientific imagination,’ trying to pierce the infinite, baffled yet hopeful.

Only for three short weeks was his work laid down before he passed peacefully through the dark vale into the light where all the puzzles of earth are unravelled.

He died at Netherhall on 17th December 1907.

Once more there was a great gathering to do him honour when, on the 23rd of December, he was laid to rest beside Sir Isaac Newton in our beautiful Westminster Abbey. The great and the learned came from far and near, the peers honouring him with their ermine robes generally reserved for royalty.

It was most impressive. The densely crowded building looked vast in the glimmering light of the candles; while the tones of the organ and the exquisite harmony of the singing filled the air. The beautiful words of the service seemed to come home to our hearts as they had never done before, because they were so true, for with all his greatness and wonderful knowledge, Lord Kelvin had walked through life a humble Christian.

A heavy pall of fog hung over the sky, but we knew there was light beyond; and as the sweet sound of the music rose through the gloom, we thought of the words, 'Blessed are the pure in heart, for they shall see God.'

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